VOL. II APRIL 1951 NO. 4

# UNITED STATES ARMED FORCES MEDICAL JOURNAL

*Published Monthly by the Armed Forces Medical Publication Agency, Department of Defense*

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THE PRINTING OF THIS PUBLICATION HAS BEEN APPROVED BY THE DIRECTOR OF THE BUREAU OF THE BUDGET, OCT. 19, 1949

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1951

For sale by the Superintendent of Documents, U. S. Government Printing Office
Washington 25, D. C.

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Subscriptions should be sent to the Superintendent of Documents, United States Government Printing Office, Washington 25, D. C.

Yearly subscription, $4; foreign subscription, $5.35.

Single number, 35 cents.

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# Foreword

The UNITED STATES ARMED FORCES MEDICAL JOURNAL represents the unification of the BULLETIN OF THE UNITED STATES ARMY MEDICAL DEPARTMENT and the UNITED STATES NAVAL MEDICAL BULLETIN. This joint periodical is the medium for disseminating information of administrative and professional interest to all medical personnel of the Department of Defense.

The Chairman of the Armed Forces Medical Policy Council and the Surgeons General of the several services invite all medical officers, dental officers, Medical Service Corps officers, Nurse Corps officers, and officers of the Veterinary Corps of the Armed Forces, and the medical consultants of the Army, Navy, and Air Force to submit manuscripts for publication in this JOURNAL.

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Address: U. S. Armed Forces Medical Journal, Bureau of Medicine and Surgery, Department of the Navy, Washington 25, D. C.

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# New Method of Printing the Armed Forces Medical Journal

The offset method of printing has been adopted for the *U. S. Armed Forces Medical Journal* beginning with this issue. In the offset process, a photographic negative is made of the copy in the exact form in which it is finally to appear. The negative is then used in the preparation of a metal plate for the printing stage. Compared with the letter press method, formerly in use, the offset process, though less perfect in some respects, offers certain worthwhile operational advantages; of particular importance are (1) simplicity (which means fewer steps in the checking and editing of proof in preparation of plates for the final printing) and (2) all the operations up to and including the preparation of the finished copy from which the negatives and plates are made by the printer are carried out in the editorial office directly under the supervision of the editorial staff. Use of the offset process permits a greater flexibility in the preparation of material for publication and makes possible the elimination of from four to six weeks in the production schedule for each issue, thus enabling a more effective use of current material.

It is believed that the adoption of the offset process will prove of value in the implementation of a program designed to increase the usefulness of the *U. S. Armed Forces Medical Journal* to the personnel of the Medical Services of the Armed Forces.

—*The Editors*

OFFICE OF THE SECRETARY OF DEFENSE
ARMED FORCES MEDICAL POLICY COUNCIL
WASHINGTON 25, D.C.

MEMO: Personnel of the Medical Services of the United States Armed Forces.

To all of us in the medical services of the Armed Forces who feel a deep sense of responsibility to our fellow men and our military comrades and who share with them the rigors, hardships, or disappointments as well as the glories or honors, there comes a true understanding of the words "shipmate," "GI," or "air crew" and with this understanding the prideful right "to belong."

Occasionally the glamour associated with our well publicized units, hospitals, and medical centers, or the appeal of the frontiers of research as yet uncharted in our laboratories causes an unseasoned and usually young officer temporarily to wander from that inviolate obligation and sense of deep responsibility which he assumed when embarking upon his career in his chosen field of the healing arts.

Whether we serve with units in the field, afloat, at advanced air bases, or at large fixed establishments let us not forget our obligations and responsibilities to ourselves and to our fellow men and military comrades to give our all if need be to a sound military medical service in full support of our combatant forces.

Richard L. Meiling

Richard L. Meiling, M.D.
Chairman

UNITED STATES ARMED FORCES
MEDICAL JOURNAL

Volume II April 1951 Number 4

# Group Panic and Other Mass Disruptive Reactions

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IN THE event of an atomic attack or sudden disaster (3) affecting a civil population, there may be widespread panic in the affected area unless there is adequate planning and organization designed to prevent and to control panic behavior. It is possible that loss of life may be greater by reason of panic than as a result of the disaster itself.

In the Texas City disaster, the explosion of the French ship, S. S. *Grandcamp*, occurred at 9:10 a. m., 16 April 1947, and 20 minutes later the nearest Army Installation, Fort Crockett, near Galveston, was contacted for aid. "At the request of the local sheriff's office, the Commanding Officer, Fort Crockett, suspended normal operations at 0930 and dispatched all available personnel, both military and civilian, to Texas City with the primary mission of evacuating injured to Galveston." (4) Furthermore, "the Army assisted the Red Cross by continuing to rescue, feed, house and administer medical aid to civilians of the stricken area until 22 April. The Army supplied over 200 doctors and nurses, medical supplies for 5,000 victims, operated 2 food kitchens serving 2,000 meals daily, plus 2 dock area canteens serving coffee and sandwiches, operated 2 refugee camps with a total of 5,000 person capacity and supplied equipment for all the above plus food for the first 2 days. Engineer, Quartermaster and other supplies including nu-

(1) Psychiatry and Neurology Consultants Division, Office of the Surgeon General, Department of the Army.
(2) Office of Chief of Psychological Warfare, Office of the Chief of Staff, Department of the Army.
(3) A disaster may be defined as a "situation, usually catastrophic in nature, in which numbers of persons are plunged into helplessness and suffering and, as a result, may be in need of food, clothing, shelter, medical care, and other basic necessities of life." When Disaster Strikes. American National Red Cross, Washington, D. C., 1948. p. 1.
(4) Annex I of Sixth Army Disaster Relief Plan, July 27, 1949.

merous trucks and ambulances, were provided and radio communications were forwarded by Fourth Army Signal Section. Army aid was withdrawn gradually as the Red Cross and civilian agencies' needs decreased and Army activities ceased on 26 April 1947." (4)

Less than 12 hours after the beginning of the Detroit "Bloody Week" race riot in 1943 (a war year), aid in controlling the riot was sought from the Army. "* * * Mayor Jeffries telephoned Governor Harry F. Kelly * * * and asked that Federal troops be summoned. The Governor transmitted this plea by telephone to Sixth Service Command Headquarters." (5)

The point in citing these examples (and numerous others could be mentioned, as well as citing those in which the Navy worked with the Army or those in which the Navy alone played a supportive or predominant role) is to show that the Armed Forces are from time to time called on to render aid to civilian populations which are unprepared to cope with major disasters. Plans for dealing with disasters including the prevention and control of panic should be developed for all civilian communities so that aid from the Armed Forces during disaster will not be required. The facilities of the Armed Forces will not then need to be diverted from other missions in time of war or national danger. "The fear reaction of the uninitiated civilian is ever evident. It is of such magnitude that it could well interfere with an important military mission in time of war." (6)

## CAUSES OF PANIC BEHAVIOR

The word "panic" has its origin in the fear and fright caused by the legendary god, Pan, son of Zeus. Panic is "a sudden, overpowering * * * and groundless fright; terror inspired by a trifling cause or a misapprehension of danger, especially when accompanied by unreasoning or frantic efforts to secure safety." (7) On the other hand, panic may occur in the presence of real or imminent danger. "Panic * * * involves temporary major disorganization of thinking and control of fear. Consciousness is usually clouded * * * * *. The most common expression of true panic on the battlefield is the panic run, in which, usually during a shelling, the soldier deserts cover and dashes about impulsively, exposing himself to flying shell fragments." (8)

Panic behavior occurs when *fear* spreads through a crowd and the crowd gets out of hand. "Panic behavior is * * * the antithesis to regimental behavior." (9) "Panic occurs where some highly cherished,

(5) Lee, A. M., and Humphrey, N. D.: Race Riot. The Dryden Press, New York, N. Y., 1943. p. 30.
(6) Cooney, J. P.: Psychological Factors in Atomic Warfare. U. S. Armed Forces Special Weapons Project. Radiological Defense, Vol. 3. U. S. Government Printing Office, Washington, D. C., 1950.
(7) Webster's New International Dictionary of the English Language. G. & C. Merriam Co., Springfield, Mass., 1944. p. 1764.
(8) Ranson, S. W.: The normal battle reaction: its relation to pathologic battle reaction. Bull. U. S. Army M. Dept. (supp.) pp. 3-11, Nov. 1949.
(9) LaPiere, R. T.: Collective Behavior. McGraw-Hill Book Company, New York, N. Y., 1938. p. 437.

rather commonly accepted value is threatened and when no certain elimination of the threat is in sight. The individual feels that he will be ruined, physically, financially or socially." *(10)* When a large number of persons gathers around a common object of interest or attention, a crowd exists. In a crowd there must be a focus or polarization of attention on "something seen, heard or sensed together." *(11)* Like filings around a magnet the crowd is drawn toward one focus of attention and action *(11)*. In another kind of a group, a radio audience, the attention is also focused on a common subject such as the voice of the speaker, orchestra music, or a play. An example of a major panic which developed among members of a radio audience occurred during the now classic "Invasion from Mars" broadcast in the fall of 1938 *(10)*.

Panic behavior is the antithesis of crowd behavior. In panic there is a flight from the common point of attention. The crowd is broken up; disorganization occurs because polarization of action and attention disappears and, along with it, the regimentation which has bound the crowd together into mass action, mass attention, and mass strength. In group panic, action is individual; there is uncoordinated interaction with other members of the group and the action by its members is usually irrational and fruitless. The members of the panic group may act together but the action may be illogical, irrational, and even dangerous to the group members.

*Tension* and *insecurity* contribute to panic. In group or individual panic, the basic emotion is fear. The predominant action is a frantic effort to escape danger, real or imagined. Tension accompanied by insecurity increases the degree of panic when the stimuli for panic are introduced into the group. Panic is "a maximal fear state which results from prolonged tension and insecurity * * * a careful study and analysis of large case material proves that a great variety of factors and situations may produce a tension in certain constitutional make-ups and that panic is the climax of tension." (12) When the group is tense and insecure and when imagined danger has not been dispelled, the stage is set for the introduction of stimuli to produce panic even in a regimented group as in the Army. "In a state of mass insecurity, people are susceptible to propaganda because there has been a weakening of the ego. Mass insecurity is pooled uncertainty together with individual inner anxiety." *(13)* An illustration of an incident of panic behavior among 115,000 soldiers who had built up a high degree of tension and insecurity was cited by Young *(14)*:

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*(10)* Cantril, H.; Gaudet, H.; and Hertzog, H.: Invasion from Mars. Princeton University Press, Princeton, N. J., 1940. p. 199.

*(11)* Young, K.: Social Psychology. 2d edition. F. S. Crofts & Co., New York, N. Y., 1944. p. 387.

*(12)* Diethelm, O.: Nosological position of panic reactions. Am. J. Psychiat. (N.S.) 13: 1295-1316, May 1934.

*(13)* Laswell, H. G.: In an address, Propaganda and Mass Insecurity, sponsored by the Washington School of Psychiatry, at the Army Medical Center, Washington, D. C., 7 April 1950.

*(14)* See p. 340 of reference footnote 11.

"A flight-fear reaction in which prior cultural conditioning and current rumor played important parts was the panic during the battle at Adawa in February 1896, an action which involved about 15,000 Italian troops and nearly 100,000 Abyssinians. The terrain was rough and cut into deep, parallel watercourses separated by steep ridges. An Italian unit advancing through one of these defiles was suddenly attacked by a small body of native troops, and almost at the first brush the Italians turned tail and fled in disorder.

"A number of factors contributed to this panic, but the most important appears to have been the rumors about the cruelty and violence of the natives. All sorts of wild tales were told and retold * * * about how the natives castrated *(15)* and tortured their prisoners. These stories made a deep impression on the men, and at the first contact with the natives there was an upsurge of fear which the officers and less suggestible soldiers were unable to check."

*Imitative behavior* contributes to panic. Imitation is a phase of individual learning and is a factor in the prior conditioning of persons which contributes to panics. Persons imitate the behavior of others and for the most part this imitative behavior is habitual and unconscious. People look when others look, laugh when others laugh, and run when others run. In imitation, there is a "similarity in motor responses, likeness in reactions due to likeness in stimuli, and the deliberate or conscious taking of the role of another." *(16)* The manner in which imitation, together with unfounded fear, may contribute to panic behavior among soldiers is illustrated in an incident cited by Altrock *(17)*:

"As the regiment was trotting back in marching column on the road, the regimental commander sent an aide to the head of the column to bring it to a walk. As this officer was galloping along from the direction of the enemy, his pace was regarded as a sign of the seriousness of the situation. When the officers tried to gain the heads of their troops by galloping, the troopers followed suit and soon the entire regiment was galloping away from the enemy, and overran a Prussian battery. Only after miles and some casualties was it possible to bring the regiment to a halt."

An imitative behavior response caused great numbers to die in the Iroquois Theater fire in Chicago on 30 December 1903. An account of the panic during the fire is quoted by LaPiere *(18)*:

"The theater itself never burned—they could have given performances in it a couple of days afterwards. But it didn't have to burn to kill hun-

*(15)* It may be reasonable to draw an analogy between the castration fears which added to the tension and insecurity of the soldiers prior to the panic stimuli and the unfounded fear, which is believed to be widespread among the population, that an atomic attack will sterilize all the survivors. (Cf. also Meerloo, A. M.: Patterns of Panic. International Universities Press, Inc., New York, N. Y., 1950. pp. 47-48.)

*(16)* See p. 391 of reference footnote 11.

*(17)* Altrock, C. V.: Panic. Infantry Journal Magazine 37: 115, Aug. 1930.

*(18)* See pp. 458-459 of reference footnote 9.

dreds. The people from the balcony were piled in the narrow arch at the head of the big gilt stairway—and already many of them must have been crushed to death. Many of those in the orchestra had mobbed the side doors, which had never been inspected to see if they would open at all. And there was another jam at the main orchestra entrance."

In the Iroquois fire, it appears that the majority of the members of the audience, in panic, mimicked the behavior of a few and attempted to escape only through several exits which had been reached initially. Mimicked or imitative behavior may lead to a panic pattern of inaction combined with what appears to be mass suicide. Along this line, the behavior pattern of inaction and mass suicide in panic may be "the result of acute depressive mechanisms (guilt and repressed hostility with introjection of resentment)." *(19)* Collective suicide was the predominant panic pattern during the sinking of the *Lusitania* in 1915. LaPiere *(18)* said:

"On the *Lusitania,* torpedoed in British waters on May 7, 1915, collective, rather than individual, suicide appears to have been the predominant panic pattern. Early in the course of the disaster, a number of overfilled and badly launched life boats sank. This fact, combined with the fact that the ship leaned so much that the remaining lifeboats had to be launched either down the sloping side or out over the water, seems to have been responsible for the establishment of a refuse-to-leave-the-ship pattern. People huddled hopelessly along the rails until the ship sank. Of the 1,954 passengers, 1,189 drowned. The hero of the occasion was an 18-year-old boy under whose leadership a few lifeboats were successfully filled and launched."

Collective self-sacrifice is another result of imitative behavior during panic. A great deal has been written of the heroic behavior of the men who went down with the *Titanic* when she struck an iceberg. LaPiere, citing a report of the U. S. Investigation Committee on the Titanic Disaster, pointed out that the heroism of the men was produced by mimicry which led to the unnecessary death of hundreds through needless collective self-sacrifice *(18)*:

"Much was said at the time, of the heroic behavior of the men who went down singing with the *Titanic.* On her maiden voyage in April 1912, this ship struck an iceberg and went down within 2 hours. Although the sea was calm, although few of the lifeboats were damaged in collision, and although 2 hours should have been ample time for the orderly filling and launching of them, only 700 passengers all told were taken off in boats which had a capacity of 1,176. Women were put to sea in undermanned boats and men went down with the ship."

*Suggestibility* contributes to panic. Crowds, groups, and audiences are highly suggestible and this factor may operate to create panics. According to Young *(20)*, "suggestion takes place when one person

*(19)* Drayer, C. S.: Personal communication.

*(20)* See pp. 391-392 of reference footnote 11.

induces an idea, belief, or act in another without the latter's use of logical reasoning. In fact the aim of suggestion is to get others to think or do something by stopping their critical habits." Probably there is no better example of suggestibility as a producer of panic than the Orson Welles broadcast on the invasion from Mars. The radio was used as the medium for inducing the suggestion, with the resultant panic *(10)*. In those thousands of persons who were panic-stricken as a result of this broadcast, there was, for them, a loss of critical judgment. Suggestion is effective when persons can be induced to lose their ability for critical judgment. In his analysis of the panic created through the Orson Welles broadcast, Cantril *(21)* stated that "critical ability * * * * is an accurate description of the most important single psychological variable related to the panic reaction. This critical ability is not likely to be a simple innate capacity that some people have and others do not have. Its genesis in the individual is the result of a particular environment which has played upon his particular capacities. *Whenever critical ability could function we discover that it was complete insurance against panic behavior.*"

In the analysis of the people who listened to the Welles broadcast, Cantril found that more of those with little education believed the broadcast to be a fact than those with more education. He said " * * * only about half as many people with a college education, as compared to those with grammar school training, believed the broadcast was a news report." *(22)* The capacity to exercise critical judgment and thus resist suggestion appears to be related to "a general capacity to distinguish between fiction and reality or the ability to refer to special information which is regarded as sufficiently reliable to provide an interpretation." *(22)* In panic resulting from the Mars broadcast, higher education was not a guarantee against loss of critical judgment because there are many other variables in the total personality which influence behavior. Twenty-eight percent of the panic-stricken sample interviewed in Cantril's study were college educated (as compared with 36 percent with high school and 46 percent with grammar school education *(22)*).

In collective mental life the increased suggestibility of members of the group keeps the intellectual processes at a low level *(23)*. "No fact has been more strongly insisted upon by writers on the psychology of crowds than the low degree of intelligence implied by their collective actions * * * The least intelligent minds bring down the intelligence of the whole to their own level * * * the effect of numbers is greatly increased if all display a common emotion and speak with one voice. The crowd has then, if we are in its presence, a well-nigh irresistible prestige. Hence even the highly intelligent and self-reliant member of a crowd is apt to find his critical reserves broken down * * * " *(23)*

*(21)* See p. 127 of reference footnote 10. (Italics are ours.) (In connection with the concept of loss of critical ability in panic behavior, cf. also reference footnote 8.)
*(22)* See pp. 112 and 117 of reference footnote 10.
*(23)* McDougall, W.: The Group Mind. Cambridge University Press, Cambridge, Mass., 1929. p. 41.

*Rumor* contributes to panic. One of the most effective means of creating panic is through the diffusion of rumor—by word of mouth, telephone, newspaper, or radio. Combined with the strong element of suggestibility which exists in collective mental life, rumor can produce panic of major proportions. Meerloo *(24)* gave an example of the manner in which rumor caused panic among German troops in Holland which led them to attempt a retreat from that country.

"When the victorious Allies swept along the coast of Belgium, and liberated Brussels and Antwerp, a few advance troops crossed the frontier into Holland. Because of confusing radio reports from London all kinds of wild rumors were in the air. Neighbors told each other about the liberation of Dordrecht and Rotterdam. The Allies were nearing. People displayed their national flags, children danced in the streets; they wore their national color (orange) and sang their national hymns again.

"The Nazi occupiers blocked all telephone communications—*they had been affected by the rumors*—and, on the same day, the German troops started their panicky retreat to the German frontier. The shops sold all kinds of liberation ribbons. For one day Holland was without enemies * * * The Germans' retreat, however, was violently stopped by their own army in Germany."

The rumors which caused the panic among the German troops in Holland are also referred to as "hope" or "pipe dream" rumors spread by the members of the population because it made them feel happy *(25)*.

Rumor to spread panic among enemy forces was used by the Genghis Khan, who depended on rumor to spread accounts of the huge numbers of his troops and their ferocity. He did not care what the enemies thought as long as they became frightened *(26)*. Through rumor, he was able to induce panic among numbers of opposing armies and weaken or completely dissipate the strength of the opposition.

A good example of the manner in which rumor may set off panic or disruptive mass behavior in the civil population is available from an analysis made of the Detroit race riot previously referred to. A long period of mounting tension among the Negro and white population was behind this riot, but rumor was the immediate or specific cause of the explosive uncontrolled behavior which resulted in the hysterical lootings and beatings which led to the death of 34 people, the wounding of more than 1,000 and the destruction of hundreds of thousands of dollars worth of property. A rumor was circulated among the Negroes, beginning with an announcement over the public address system by an entertainer at a Negro night club who urged the 500 patrons "to take care of a

*(24)* Meerloo, A. M.: Patterns of Panic. International Universities Press, Inc., New York, N. Y., 1950. p. 9.

*(25)* For a discussion of this concept, cf. Subcourse 50-41c, Lesson 3 "Extension Course of the Command and General Staff College," Ft. Leavenworth, Kans., 1 June 1949.

*(26)* Linebarger, P. M. A.: Psychological Warfare. Combat Forces Press, Washington, D. C., 1948. p. 15.

bunch of whites who killed a colored woman and her baby at Belle Isle park." *(27)* A popular version of the rumor which was spread was to the effect that white men had thrown a Negro woman and her baby into the river. "Then it started. By 4 a.m., 400 stores owned by whites in the colored district had been wrecked, looted, pillaged and destroyed. A street car had been stopped and 50 white factory workers were taken out and beaten. It was 5 a.m. before the whites started to retaliate." *(28)* The version of the rumor which set off the white population to riot was that Negroes had thrown a white baby off a bridge. Other versions were that two white women were attacked by Negroes on a bridge and that white girls were attacked by Negroes while swimming *(29)*.

Another example of the development of rumors in community disasters is cited by Hanson *(30)* in his report of the effects of the ammunition explosion at South Amboy, N. J., which occurred on 20 May 1950. He found that many spontaneous rumors began immediately after the explosion and that these rumors developed simultaneously in different places. The rumors which circulated included those which were to the effect that another explosion was pending; that an atomic bomb had struck the community; and that there might be poison gas coming from the chemical works.

*Fear of the unknown* contributes to panic. Lack of knowledge about natural and social phenomena is believed to contribute to panic behavior. Today, a total eclipse of the sun is not likely to produce panic, but before the rise of astronomy, such an eclipse could produce a major crisis among people *(31)*. Interesting examples of the manner in which fear of the unknown (lack of knowledge of natural phenomena) caused panic in the "Martian invasion" of the Welles broadcast were given by Cantril *(32)*. A northern New Jersey housewife described her reactions as follows:

"I knew it was something terrible and I was frightened * * * But I didn't know just what it was. I couldn't make myself believe it was the end of the world. I've always heard that when the world came to an end, it would come so fast nobody would know—so why should God get in touch with this announcer? When they told us what road to take and get up over the hills and the children began to cry, the family decided to go out."

A woman in a New York suburb described her reactions to the Welles broadcast as follows:

"I never hugged my radio so closely as I did last night. I held a crucifix in my hand and prayed while looking out of the window for

*(27)* See p. 27 of reference footnote 5.
*(28)* See p. 21 of reference footnote 5.
*(29)* See p. 20 of reference footnote 5.
*(30)* Hanson, F. R.: Preliminary Report on Psychiatric Investigation of South Amboy Explosion; unpublished report. Psychiatry and Neurology Consultants Division, Office of the Surgeon General, Department of the Army, Washington, D. C., May 1950.
*(31)* See p. 438 of reference footnote 9.
*(32)* See pp. 47-48 of reference footnote 10.

falling meteors. I also wanted to get a faint whiff of the gas so that I would know when to close my window and hermetically seal my room with waterproof cement or anything else I could get hold of." *(33)*

The panic reactions of an entire family group to this broadcast was described by one of the members of a family living in a small midwestern town as follows:

"That Hallowe'en Boo sure had our family on its knees before the program was half over. God knows but we prayed to Him last Sunday. It was a lesson in more than one thing to us. My mother went out and looked for Mars. Dad was hard to convince or skeptical or sumpin', but he even got to believing it. Brother Joe, as usual, got more excited than he could show. Brother George wasn't home. Aunt Grace, a good Catholic, began to pray with Uncle Henry. Lily got sick to her stomach. I don't know what I did exactly but I prayed harder and more earnestly than ever before. Just as soon as we were convinced that thing was real, how pretty all things on earth seemed; how soon we put our trust in God." *(34)*

In the examples given above, panic was produced because critical judgment was dissipated. The lack of knowledge of the phenomenon described in the broadcast made it impossible for these people to "cross-check with reality" and they succumbed to panic behavior. There is always a danger of panic when mysterious new weapons are introduced because the unknown potentialities of the weapon cause fear. Levi quoted by Meerloo *(35)*, described a wave of panic which Levi observed among the people of Paris because of the fear of mysterious new weapons:

"I was in Paris on September 1, 1939, when Hitler's armies were marching across the plains of Poland and a formal declaration of hostilities was expected from one moment to the next. The city was swept by a wave of panic greater than anyone can imagine who did not see it with his own eyes—a vague, shadowy terror, which was due only in part to the concrete fear of mysterious new weapons, such as poison gas and asphyxiating bombs."

The potential panic-producing possibilities of the atomic bomb were suggested by Tsuzuki *(36)* who stated that "* * * at the moment of the explosion of the atomic bomb, darkness and confusion suddenly spread. * * * its terrible scene could never be expressed by either tongue or pen."

*Lack of preparation* contributes to panic. People may revert to panic behavior in times of crisis or disaster when they have not been pre-

*(33)* See pp. 49-50 of reference footnote 10.
*(34)* See p. 48 of reference footnote 10.
*(35)* See p. 49 in reference footnote 24.
*(36)* Tsuzuki, M.: Report on the Medical Studies of the Effects of the Atomic Bomb. General Report, Atomic Bomb Casualty Commission, National Research Council, Washington, D. C., Jan. 1947. p. 76.

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pared to react in a more positive or fruitful manner. Young (37) stated that "previous conditioning determines very largely, though perhaps not entirely, what we do." He said:

"* * * even in temporary crowd responses, the apperceptive accumulations give a direction to our responses. These internal factors may be largely in the nature of highly charged emotional attitudes and responses, but nevertheless the predispositions of the individual are important in his reactions. The writer once witnessed the varied responses of a theater audience when a fire broke out. Most of the spectators made a rush for the doors, but a former fireman in the audience reached one set of doors ahead of the others and threw his weight against the crowd in an effort to hold the doors closed. There was great excitement until he shouted a few orders * * * The vast majority, driven by natural fear, ran from danger as rapidly as possible; but the fireman's training had set up a set of predispositions which cut across his own natural impulses, and caused him to act for the ultimate safety of the group. His apperceptive background produced calmer and more rational responses, whereas those of the others rested on prepotent tendencies to flee from danger."

Dr. Barbara J. Betz (38) stated that previous training asserts itself when people react to a disaster situation and that their prior training will govern the behavior pattern to a large extent. She said that after the initial anxiety resulting from an atomic raid has passed off, previous training will assert itself and people will tend to do whatever they know best or what they have been told to do beforehand; "Doctors, for example, begin to doctor; ministers, administer; mothers mother their children, and policemen direct traffic."

Davies (39), reporting on the initial air raids of Barcelona in 1938, cited the widespread panic of 1.5 million people for 40 hours because the air raids (from 6 bombers) were entirely unexpected. No preparation had been made for the raids and no instructions had been given to the people prior to the raids. He stated that "26 minutes of visits from half a dozen bombers themselves scarcely in danger destroyed the whole mental life of a 1.5 million people for 40 hours." In this connection Martin (40) said that "being caught unaware is a major cause of panic; therefore the truth about everything must be told and accepted." The effectiveness of fire drills in eliminating panic among school children is well known. Training of soldiers reduces their susceptibility

(37) Young, K.: Social Psychology; an Analysis of Social Behavior. F. S. Crofts & Co., New York, N. Y., 1930. pp. 518-519.

(38) On March 31, 1950 in an address entitled *Psychological Effects of Atomic Warfare*, delivered at Johns Hopkins University School of Public Health at a course sponsored by the Atomic Energy Commission and National Security Resources Board. Cf. also *The Evening Sun* (Baltimore) April 1, 1950, and *The Sun* (Baltimore), same date.

(39) Davies, L.: Air-raid: The Technique of Silent Approach. G. Routledge, London, 1942. p. 34.

(40) Martin, A. R.: Prevention of panic. Ment. Hyg. 26: 546-553, Oct. 1942.

to group panic in times of major stress. Pew *(41)* stated that "the fact that untrained men are more susceptible to panic suggests the means of control."

Lack of preparation, as a cause of panic, means also failure to provide adequate leadership in the event of a possible disaster. In a disaster, "unless * * * leadership operates, the collective behavior will be panic in type." *(42)* The chaos resulting from the Texas City Disaster might have been avoided had there been coordinated leadership. Annex I of the Sixth Army Disaster Relief Plan *(4)* stated that "local sources were inadequate to cope with the situation; 40 percent of the city's residents had fled or were fleeing the city and general chaos resulted." In connection with the explosion of the S. S. *Grandcamp* at Texas City, this report pointed out that "this disaster clearly demonstrated the need for a definite policy in meeting disaster on the Army level and the need for planning with civilian agencies and the Red Cross." The need for coordinated leadership in preventing panic is stressed here as an element of preparation which is necessary to control or minimize panic behavior in the event of atomic attack.

*Strong sensory stimuli* contribute to panic. In a disaster, people may hear the loud noise, smell objects burning, and see people running. These sensory stimuli heighten excitement and contribute to panic behavior. Auditory stimulus is discussed here because it contributes greatly to panic behavior and because it suggests a method for conditioning the population and minimizing panic. Schmidberg *(43)*, describing British experience, stated that "auditory impressions in war exercise the strongest effect of all on our nerves. The whistling of falling bombs, the sounds of their explosions, and the boom of the anti-aircraft guns mingle in the inferno of noise with shattering effects on the nerves. On top of this comes an auditory illusion, repeated explosions suggesting that the danger is coming closer." In the Gallic War, Julius Caesar's enemies recognized the value of auditory stimulus in creating panic and confusion among Caesar's legions by yelling and knocking their weapons together to produce loud and fearful noises.

That Hitler's generals recognized, or at least used, auditory stimuli in creating fear among the civilian population was suggested by Schmidberg who stated: "I am told that when Vienna was occupied last year the intimidation of the populace was effected by the deafening roar of low-flying squadrons of aeroplanes; indeed, that many persons found themselves paralyzed by it." *(43)* A more recent example of noise significantly adding to the confusion of a community disaster was reported by Hanson *(30)* in the South Amboy explosion. During the period immediately following this disaster, fire trucks and other cars equipped with sirens "raced around town, apparently aimlessly, with their sirens going and this added to the confusion."

*(41)* Pew, W. A.: Making a Soldier. R. G. Badger, Boston, Mass., 1917. p. 196.
*(42)* See p. 458 in reference footnote 41.
*(43)* Schmidberg, W.: Treatment of panic in casualty area and clearing station. Life and Letters Today *23*: 162-169, Autumn 1939.

## PREVENTION AND CONTROL OF PANIC BEHAVIOR

Although knowledge of the causes, prevention, and treatment of panic is far from complete and much research needs to be done *(44)* there is enough available information to provide a tentative approach to the problem. The prevention and control of panic behavior resulting from an atomic explosion or other disaster involve a multiple approach. Among factors to be considered are organization, education, leadership, and motivation.

*Organization.*—The American Medical Association film, "They Also Serve," is a good introduction to preliminary planning. The following general civic functions must be maintained and must continue to operate in the face of confusion, disorganization, and partial destruction:

1. Communication.
2. Police.
3. Fire.
4. Engineering, to include removal of debris or other hazards.
5. Transportation.
6. Rescue and first-aid services.
7. Medical and health services.
8. Sanitation.
9. Evacuation of population, if indicated.
10. Human welfare to include shelter, food, and information to disaster victims.
11. Radiologic defense.
12. Chemical warfare defense.

Specific attention and special measures are needed for 11 and 12.

Within the framework of planning for the defense of the civilian population there should be organized activities in each community, by neighborhood, down to each person who has a specific role to play in some phase of an activity. Organized activity promotes discipline and control and, as a result, there will be less likelihood of confusion and explosive mass-behavior in the event of a disaster affecting the community. Planning should not end with the organization of a single community as an isolated unit, because in the event of mass disaster, cities should be able to support one another and even larger divisions or geographic regions of a country should be prepared to act cooperatively. In the development of cooperative activities between cities, some will be identified as friendly to each other while others will be categorized as rivals. The attitude of friendliness and rivalry might be used in the defense planning by having one friendly city aid the population of another friendly stricken city and by urging the populations

*(44)* U. S. Air Force Project Rand: Proposals for Field Research on the Psychological Impact of Peacetime Disasters. Also, Research Planning. The Rand Corporation, Santa Monica, Calif., Jan. 1949.

of rival cities to excel each other in their respective defense activities (45).

*Education.*—One of the major causes of panic is fear, and fear of the unknown promotes disorganized behavior. Education and knowledge diminish the threat of unknown or fantastic dangers. That which is known can be planned for; if unknown, the threat is the more powerful in that there can be no effective planning for security or survival. Therefore, sound, basic, and factual knowledge of potential dangers should be made freely available. If the critical judgment of people can be increased, panic behavior can be prevented or minimized in the event of atomic attack. Cantril (46) said: "And education, we discovered, was one of the greatest preventives of panic behavior." Through education of civil groups, the tension and insecurity which may be building up among the population can be minimized. If there is an organized, systematic, and effective educational program, critical judgment will be increased, fears of the mysterious and unknown can be dispelled, and a means for "cross-checking reality" can be provided which will make the group less susceptible to rumor.

Because we may expect imitative behavior to take place in group interaction following a major disaster, a plan for panic control needs to embody plans for training persons and groups for specific leadership so that imitative behavior can be turned into constructive action instead of fearful flight. The educational program can serve the purpose of dissipating lack of preparation as one of the major causes of panic. If the program is effective, each person will be prepared, to some degree, for the disaster should it occur. Simple factual knowledge is contained in table 1.

Information should be made available on fear and how people react to fear. Fear is a common normal reaction in the face of danger and verbal expression of fear is permissible. Uncontrolled fear engenders infantile types of behavior, passivity, apathy, even a denial of the presence of danger, or explosive behavior, fury, or a blind desire for escape. Even death may occur solely as a result of extreme fear. On the other hand, "wolf! wolf!" technics may make a population apathetic. Constant and repeated raising and lowering of levels of emotional tension may render people indifferent and listless and foster lessened susceptibility to panic behavior. Such populations would also be less efficient and productive as well.

Information on the harmfulness of rumors (47) should be widely disseminated. Rumors spread with incredible rapidity, can disrupt military or civilian morale and promote friction between groups and even nations. Rumors may be expected when the subject is important and when

(45) Meade, M.: Unpublished data.
(46) See p. 204 of reference footnote 10.
(47) Department of the Army: What's the Latest Rumor? Armed Forces Talk 224, Washington, D. C.

TABLE 1.—*Air bursts of atomic bomb (1)*

WHAT HAPPENS

| Physical activity | Percent of casualties | Effects | Evidence |
|---|---|---|---|
| Blast | 65 | Positive phase (pushing out). | Pressure out from burst. Usually not enough to kill. Flying debris causes almost all injuries. |
| | | Negative phase (sucking in). | High winds up to 100 miles per hour. Blows toward center of burst and up into cloud. |
| Heat | 20 | "Flash" heat. | Flash at the time of burst. Burns occur out to 2 miles. Light clothes or any shielding substance afford protection. |
| | | Secondary fires. | Started by stoves, short circuits, et cetera. Cutting off utilities will prevent these fires. |
| Radiation | 15 | "Flash" radiation (gamma rays and neutrons). | Cannot be seen, heard, or felt, but it is there for a flash. Gamma rays are most penetrating and have longest range. The more material between you and the blast the greater the protection. Gamma radiation decreases as the square of the distance from the burst. |
| | | Lingering radiation (alpha and beta particles) | So small that it is not a hazard. Disregard it. |

WHAT TO DO

| | |
|---|---|
| *Disperse.* | If warning is given get away from possible target area and areas that are built up to avoid the flying debris. |
| *Take cover* and stay for about 90 seconds. | Use basements or underground shelters if possible. Get close to basement walls and near good exits from basement after burst. Remember, *get the most material between you and the burst.* |
| *Help others.* | Thousands of lives can be saved by prompt aid. Help save lives by helping others. *90 seconds after burst the debris has stopped falling and there is* no radiation hazard. |
| *Report* to designated place. | Organization is necessary to reduce the effects of the bomb. Report to *receive treatment* if necessary; *to be evacuated* if desirable; and to *work to help others.* |
| *Don't eat, chew, drink, or smoke* until items are checked and cleaned. | *A small amount of radiation outside the body is harmless. Inside the body it may cause much trouble. Keep it outside.* |
| *Don't spread rumors.* | *Things will be tough all over.* Keep your experience to yourself and don't enlarge on what you hear from others. |
| *Scrub down* and *change clothes.* | As soon as practicable, scrub down and change clothes. Scrub hair, face, hands, and fingernails well. |

*(1)* From unclassified material provided by the Armed Forces Special Weapons Project and first published in an article, "Medical Planning for Atomic Disaster," by W. L. Wilson, in the Journal of the Florida Medical Association, Oct. 1950.

there is uncertainty about the facts. Although some rumors may be deliberately started, most rumors begin from a modicum of truth that is elaborated, distorted, misinterpreted, mangled, and constantly magnified with each retelling. Rumors provide answers for questions that need answering, they offer excuses for actions, they relieve emotions, and perhaps most important of all, they make the teller feel important. In general, rumors may be classified as *fear, wish,* or *hate* rumors. Of these, the hate rumor is the most widespread and vicious. Rumors can be stopped by getting the facts, by finding out who said it, and the authority for it, by being skeptical, by ridiculing, and by being on the alert for rumors and labeling them as such.

There should be information on mental health and mental first aid under disaster conditions. For example, Tyhurst (48), as the result of his observation of people, believes that there are three reaction periods in disaster situations:

1. The *impact period* lasts during the emergency or danger situation itself. The behavior of the people may be confused, disorganized, and panicky. It may also be of a semiautomatic nature. In the face of emergencies, persons may, as though in a trance, calmly proceed to perform more or less aimless or otherwise useless acts. Well known is the tendency for an occupant to take, say, an umbrella from a burning building and leave clothing, money or other valuables behind, or to pass by a fire extinguisher while looking for a bucket to carry water. Intensive training promotes prompt and efficient reactions to emergencies, but the training must be so ingrained that responses become habitual or automatic and take precedence over more primitive forms of automatic behavior.

2. The *recoil period* follows immediately after the impact period and may last for from several hours to a day or more. Persons may show apathy, childish dependency, or hostility to other survivors or to those who attempt to help them. A need may be shown for scapegoats.

3. The *post-traumatic period* is characterized by the development of more easily recognized types of psychoneurosis, psychosomatic symptoms, or delinquent behavior patterns.

Knowledge regarding types of mental reaction under extreme stress and principles of treatment as outlined in Combat Psychiatry (49) may well be helpful in the planning for civilian groups inasmuch as the front line may be in the civilian community itself under conditions of aerial or atomic attack. Everyone should be well informed regarding physiologic and psychologic symptoms that may be manifested as the result of continued severe stress and/or fear.

1. *Normal psychologic reactions* to severe stress and/or fear may include: irritability; insomnia; heightened sensitivity to loud or un-

(48) Tyhurst, J. S.: Unpublished data.
(49) Combat Psychiatry. Bull. U. S. Army M. Dept. (supp.) 9: Nov. 1949.

expected noises whereby more or less automatically a person becomes tense and is prepared to react promptly in the face of danger or threat—a sort of "on-guard" reaction; resentment; anticipatory anxiety that gradually increases in the face of recurrent or increasing danger; loss of interest, initiative, mental concentration, and increased dependence on others.

2. *Normal psychosomatic reactions* to severe stress and/or fear include: generalized increased muscular tension (a person feels as though he has "tightened up"); tension headache; momentary inability to react or respond to danger, i. e., "freezing;" shaking and tremor; excessive perspiration; chilly or hot sensations; loss of appetite; vague abdominal distress; diarrhea; frequency of urination, day or night; rapid pulse; breathlessness; consciousness of irregular heart beating; sense of oppression in the chest; faintness and giddiness; generalized muscular weakness and lassitude; and marked physical fatigue.

3. *Abnormal reactions* to severe stress and/or fear include: grossly incapacitating shaking and tremors, lasting for hours after the immediate danger is over; fainting under stress; oversensitivity to nonspecific noises unconnected with the source of danger; continued insomnia after the immediate danger has passed; the presence of gross functional impairment such as paralyses, contractures, blindness, deafness, i. e., conversion hysteria; pseudopsychotic reactions; continued depression and guilt feelings; pathologic fear such as panic with clouded consciousness and disorganization of thinking and control.

*Leadership.*—Morale is directly related to the quality of leadership. When leadership is competent, morale, efficiency, discipline, and productivity are high, and tendencies to panic and disorganization are lessened. The best leaders in times of stress are not necessarily those who are best under more peaceful conditions. Some specific population leaders needed to be available in times of emergency may be identified by ascertaining those persons in a community whose advice is sought by other members of the community and whose views are respected. Such potential leaders are often relatively inconspicious, unassuming, and retiring. It is important in group management, for leaders to isolate subversive or destructive persons (primary reactors) who act as instigators promulgating undesirable and potentially explosive mass behavior reactions. Often such persons are unobtrusive, difficult to identify, act as behind-the-scenes operators, and set in motion other persons (secondary reactors) of whom only the latter may be obvious and prominent in their disturbing activities.

Qualities demanded of leaders have been outlined by a number of military and civilian writers with variable conclusions. Lee (50) studied the problem of leadership from the viewpoint of the follower in a civilian industry. Important points are:

(50) Lee, R.: Humanics in business. Asta Journal 36: 84-88, Jan. 1949.

1. To be a leader one must be followed. A follower will not follow another simply because that person wishes him to follow. Unless the follower believes he will benefit in following another he will not follow. Pressure, titles, and authority cannot and will not force him to follow.

2. The prospective follower wants a leader who (a) is not afraid of his job, for his job, or of someone who threatens his job, or of competition, or of honest mistakes; (b) is enthusiastic; (c) believes the job is important; (d) will fight for him at all costs if he believes him to be in the right; (e) will keep him informed; (f) will recognize him as a fellow human being; (g) will listen to him and understand him; (h) respects his pride and never under any circumstances or provocation bawls him out in the presence of others; (i) knows most of the answers, but will admit it if he doesn't; (j) is predictable; and (k) is fair.

The quality of fairness expected of leaders is exemplified by the usually orderly and good natured sugar-ration lines in this country during the last emergency. Everybody got the same amount of sugar and no favoritism was shown. On the other hand, gasoline ration lines were frequently disorderly and some people got more gas than others.

A leader becomes ineffective if he cannot communicate with his group. Therefore, it is important to maintain a communication system capable of providing accurate information or directions under any and all conditions. Reporters over such systems of communications should have calm, flat, unemotional voices. Sensationalism is to be avoided and the flash, rumor method of reporting may become quite disruptive. Information should be factual, and rumor, speculation, or unverified data avoided. It should be realized that destructive rumors and conflicting directions may be spread by subversive agents if such agents are able to seize control of the official information service or the communication network.

*Motivation.*—In spite of difficulties, deficiencies, and obstructions, persons and groups succeed in goals and objectives if they have the will to do so. MacLean *(51)* has pointed out the importance of the ethical conscience of a people as related to courage, fortitude, endurance, loyalty, trust, and honor, but as Marshall *(52)* noted, it is impractical to base any policy on exaggerated notions of man's capacity to endure and to sacrafice on behalf of ideals alone. The basic needs of man, and hence his motivations, have been listed as hierarchies by Maslow *(53)*. Man is a wanting animal and as soon as one need is filled, another takes its place. Nonetheless, needs or motivations occur in a certain priority which may vary from person to person. In general, needs take precedence as follows:

*(51)* MacLean, A. R.: 'No disease.' Canad. M. A. J. 56: 321-324, Mar. 1947; also, Canad. J. Pub. Health 38: 243-248, May 1947.

*(52)* Marshall, S. L. A.: Men Against Fire. Wm. Morrow & Co., Inc., New York, N. Y., 1947.

*(53)* Maslow, A. H.: Preface to motivation theory. Psychosom. Med. 5: 85-92, Jan. 1943. Theory of human motivation. Psychol. Rev. 50: 370-396, July 1943.

1. *Physiologic needs.* Satisfaction or gratification of basic physiologic (hunger) and sensual needs. Purely sex needs. Margaret Meade has stated that much information on feeding mixed ethnic groups has been accumulated. In such feeding no foods should be mixed. For instance, no milk should be put in anything. Milk should be in a pitcher. Seasoning should not be added but placed in separate containers to be added on individual preference. All food elements should be pure and mixed or added as different ethnic groups find it necessary. If foods are mixed, no matter if appetizing or nutritive, they may be refused because of group prejudices. In times of stress, food quiets anxiety. This is one reason for preference in quality and quantity being put into food for submarine crews. In panic situations affecting Americans it would be highly desirable to have food available in large quantities. Specific articles of food are sometimes necessary and are required for their morale or other value over and above any nutritional requirement. For example: coffee, tea, sugar, and tobacco. Onions were critical for use by British housewives. Their food was so tasteless that it required onions to make it edible.

2. *Safety needs.* Insurance against pain, danger to life, overwhelming threats, and the need for an organized, reliable, familiar, and manageable world.

3. *Love needs.* Love, belongingness, acceptance, a place in the group, both giving and receiving affection (sex needs may be added).

4. *Esteem needs.* Self-esteem, self-respect, self-confidence, respect from others, prestige, appreciation, achievement, adequacy, independence, and freedom.

5. *Self-fulfillment.* Self-expression, full use of capacities, social ideals of justice, freedom, order, full information, and desire to learn, know, and understand in a broad sense.

Behavior typically has more than one motivation and causally is multidetermined. It would be a mistake to assume that all our motivations are biologic in nature and based solely on love (including self-preservation) and hate. Personality is influenced by both innate drives and influences from without in the social as well as the personal or immediate environment. Behavior is bio-psycho-socially determined in the matrix of innate drives or inner disposition as shaped by the coincidence of social opportunity *(54)*. Stability or instability of the individual personality, and hence of groups, is related to levels of tension and anxiety as generated in family relationships, child rearing, educational systems, industrial practices, social customs, economic status, religious tensions, personal liberty and civil rights, prejudices, and intergroup and international tensions.

*(54)* GAP Report No. 13.: The Social Responsibility of Psychiatry, a Statement of Orientation. July 1950.

At the same time, prevailing attitudes must be carefully considered. Attitudes are related to performance and nonverbal behavior *(55)*. If World War I demonstrated the importance of the proper use of aptitudes, then World War II demonstrated the importance of attitudes in predicting performance and behavior. The central orientation of the American character is self-interest to the point of domination of all other values; authority and its corollary discipline are given low values; the American has ideals of self-initiative, independence, individual freedom in religious, economic and political affairs, and success through personal endeavor and intense individual competition *(56)*. On the other hand group solidarity is valued highly, as witnessed by fraternities, sororities, clubs, fads, or keeping up with the neighbors. The identification of a person with a group as his own (the belief that the group is responsible for him and he for it) is one of his strongest supports in time of stress *(52)*. "The things that induce a man to face life bravely are friendship, loyalty to responsibility, and knowledge that he is the repository of the faith and confidence of others."

## CONTROL OF GROUP PANIC

In planning for the defense of population groups, the possible development of panic must be assumed, and plans for its control must be developed. Prevention will be the best control. Preventive measures will be essentially those which are necessary on a greater scale for control of overt panic once it has started. Prevention and control of group panic is a function of central authority (especially of the police and peace officers). Physicians and psychiatrists in staff relationship to such authority will act in an advisory capacity.

Evacuation of persons or sections of populations after an enemy attack will entail psychologic dangers. In support of this statement, it is well known among military authorities that evacuation of troops in the face of enemy action must be carefully controlled, because it carries with it the danger of group panic. Troops must be carefully informed, as to why they are being evacuated and how and where the new line of resistance will be established. As has been suggested earlier, unexplained, unexpected rearward movements of even a few men can cause a rout, even among good troops. By analogy, after disasters affecting civilian populations resulting from enemy action, evacuation should be de-emphasized and strictly controlled. Any but the most carefully regulated and disciplined evacuation will tend to disrupt transportation, clog roads, dissolve group and family ties, and tear persons away from any useful group role in disaster control and restoring the community.

Group panic involves unreasoning, uncritical, and unadaptive movement of groups toward escape from danger. Suggestibility is high, abil-

*(55)* Stouffer, S. A., et al.: The American Soldier; Vols. I and II. Princeton University Press, Princeton, N. J., 1949.

*(56)* Spindler, G. D.: American character as revealed by military. Psychiatry *11*: 275-281, Aug. 1948.

ity critically to assess reality is low, and the danger of imitative response to apparent escape patterns is great. A panicked crowd is a disorganized herd, usually without leadership, and with only a vague unplanned aim of escape from danger. Fortunately, panic groups fatigue, and after a period of concentrated emotional upheaval and group motion, the members of the panic group can be diverted or dispersed. Then, under strong leadership, integrating group mechanisms and influences can be invoked, and panic brought under control. These considerations make it advisable to establish road blocks along routes of egress at intervals from the center to the periphery of an affected community. Single persons, groups of persons, and vehicles moving outward in an unplanned and unauthorized manner should be diverted into areas suitable for assembly of large numbers of persons and vehicles.

At such assembly points, accurate information as to the nature and the extent of the attack and the resultant damage should be broadcast. Able-bodied persons should be formed into groups and dispatched back to the damaged area to aid in rescue work. In the case of atom bombing (high level attack), it should be made clear that the danger from residual radiation is nil, and that the danger of a repeated attack is also nil. Persons who have escaped gross injury should be informed that the attacked city is now a relatively safe spot. Emphasis should be placed, in such broadcasts, on the job remaining to be done: i. e., rescue work, fire-fighting, and the re-establishment of the community. There should be provision for feeding the collected group. Persons manning assembly points should be specially trained and suitable for leadership in a potentially confused situation. They should be capable of speaking effectively to groups and of imparting information and commands.

## TREATMENT OF THE PSYCHIATRIC CASUALTIES RESULTING FROM A GROUP DISASTER

A soundly conceived program for treating the psychiatric casualties will contribute to the stability of a community under enemy attack. The treatment program should reinforce integrative group mechanisms and insure that individual panic reactors are placed under treatment. The clinical course and prognosis of psychiatric casualties of disasters involving civilian populations will be strongly influenced by group and social mechanisms (as has been true in the combat neuroses). Administrative and organizational policies should be planned to prevent indiscriminate evacuation, crystallization of neuroses, and impairment of the morale and efficiency of the population. The plan for treating the psychiatric casualties of such a disaster probably should parallel that which has been developed for the care and treatment of military combat neuroses on the basis of World War II experience *(49)* *(57)* *(58)*.

*(57)* Department of the Army: Training Circular No. 6, Sec. I: Neuropsychiatric Casualties. 7 Apr. 1950.

*(58)* Ranson, S. W.: Psychiatric treatment in combat areas. U. S. Armed Forces M. J. *1*: 1379-1397, Dec. 1950.

Definite channels for evacuation of neuropsychiatric cases should be established, emphasizing positive control of screening, treatment, and evacuation. Emphasis should be placed on treatment as close to the scene as feasible, shortening of the period of hospitalization, avoidance of unnecessary hospital atmosphere, and promotion in the patient of the expectation of rapid recovery and return to the population. In psychodynamic terms, treatment should be organized to (1) preserve the patient's identification with his community, job, and family; (2) minimize the secondary gain of neurotic illness; and (3) avoid suggestion of illness and disability. Therapeutic principles should thus be implemented by group manipulation.

Before any medical personnel see them, psychiatric casualties should receive what might be called "psychiatric first aid" from members of their own family and other nonmedical persons. If they enter medical channels, they should be first seen at "casualty collecting points" (stations roughly equivalent to Army battalion aid stations). Here simple, but, for many patients, definitive therapy and disposition would be given. Casualty collecting points should be able to return a large percent of psychiatric casualties to the population with no further requirements for medical care. Those requiring treatment beyond the capabilities of the casualty collecting point should receive further evaluation and treatment at secondary or clearing hospitals (installations functionally resembling Army divisional clearing stations). Here, depending on the situation and the holding policy prevalent, from 20 to 60 percent of all patients should be returned to the population. Those requiring more extensive care and treatment should be evacuated to outlying (base) hospitals.

"Psychiatric first aid," administered by nonmedical persons should consist first of a common-sense "sizing-up" to determine whether medical care is necessary. In most cases, the latter would be neither necessary nor desirable. Instead, the wavering person should be supported by reassurance, leadership, and exhortation. In this way, persons with relatively trivial reactions would be kept out of hospitalization channels, where dissolution of group ties and the factors of secondary gain and suggestion of illness tend to promote lasting patterns of psychiatric illness. Formal medical treatment would be encountered first at the casualty collecting point. Physicians there in almost all instances would not be psychiatrists. It is believed, however, that simple measures well within the capabilities of any physician properly indoctrinated would make possible the return to the population of from 50 to 60 percent of psychiatric patients. Psychiatric management at this level would be of extreme importance. Treatment at the casualty collecting point can be discussed under (1) treatment of fatigue, exposure, and exhaustion; and (2) psychotherapy proper.

1. Most persons admitted to the casualty collecting point probably would exhibit mild to moderate anxiety reactions. Many also would

show effects of exposure and physical exhaustion. Consequently, although the first brief interview might give the impression that many should be evacuated and hospitalized, most of them probably would be sufficiently relieved of symptoms if they could be given sleep, sedation, and food in the vicinity of the casualty collecting point for 24 hours. Sedation should be adequate. Probably 0.4 or 0.6 gram of amobarbital sodium orally, or its equivalent in pentobarbital would be required. Every effort should be made to get casualties cleaned up, dry, and adequately fed.

2. *Psychotherapy* at this level would vary with the type of case, and of necessity would be superficial. The attitude of the physician would be important. He should be understanding, but firm. His decisions should carry an air of calm confidence. His manner should indicate that he expects rapid remission of symptoms and return to the population. Every attempt should be made by proper organization and administration to prevent the station from becoming confused and crowded. Many patients would show symptoms which are essentially those of a fear reaction, normal and consistent with the situation. The true nature of the reaction would often not be evident to the patient, who would tend to misinterpret the psychologic and somatic manifestations of the normal fear reaction and consider himself organically or psychiatrically ill. Physicians, however, must be prepared to evaluate the fear reaction correctly, and set it into its proper context for the patient.

Although persons with such reactions may well consider themselves ill, as a result of misinterpretation of palpitation, nausea, tremulousness, et cetera, and believe that they have developed heart disease, gastrointestinal disease, or some other physical disorder, such reactions are within the normal range of response to overwhelming fear, and require no prolonged psychiatric treatment. Such patients will benefit by explanation and reassurance. In appropriate cases, there should be a brief but adequate examination of the pertinent organ system. If this is negative, the patient should be told this promptly and decisively. The cause of the symptoms may be explained in brief, simple terms. If these persons are carried through the first period of reaction, it can be expected that their symptoms will subside. No disability will result, and no formal psychiatric treatment will be necessary.

Patients with from mild to moderate anxiety reactions, complicated by varying degrees of exhaustion and exposure, should be treated chiefly by sedation and by measures to combat exhaustion and exposure, as outlined above. Psychotherapy should be superficial, and limited chiefly to reassurance, support, and exhortation. After 24 hours, a great share would be completely recovered, or greatly improved, and able to return to the population. Others, unimproved, or insufficiently improved, would require evacuation for more definitive psychiatric care.

Certain patients would be unsuited for management at the casualty collecting point. Chiefly, these would be those with (1) disturbed anx-

iety reactions associated with severe agitation and tension, (2) acute panic states, (3) marked hysterical manifestations, and (4) acute psychoses. Such patients should be sedated adequately prior to evacuation. Most of them will have a much greater tolerance to the barbiturates than have average persons. The dosage of sedative would depend on the severity of the patient's reaction. Commonly it would be 0.4 or 0.6 gram of amobarbital sodium, or its equivalent in pentobarbital. In general, it would be wise to allow sedation to take maximum effect before evacuating the patient. Care should be taken to avoid unnecessarily converting a walking patient into a litter patient by over-sedation.

Treatment at casualty collecting points would involve: (1) careful and realistic screening and classification of patients, with evacuation of only those with severe reactions and manifestly in need of hospital care; (2) treatment for as many patients as possible on an ambulatory basis; (3) provision of measures at or near the casualty collecting point to relieve fatigue, hunger, and the effects of exposure; (4) exhibition of an attitude of sympathetic firmness which expects recovery and return to the population of most patients; and (5) adequate sedation, for those patients in whom it is indicated.

If evacuated from casualty collecting points, psychiatric patients would be received at secondary or clearing hospitals. Treatment there can be discussed under: (1) treatment of fatigue and exposure; (2) alleviation of deprivations; and (3) psychotherapy proper.

1. *Treatment of fatigue and exposure.*—Although many patients may have received some previous treatment for fatigue and exposure at casualty collecting points, a large share may nevertheless arrive at secondary or clearing hospitals fatigued, hungry, dirty, and cold. For these, rest under sedation should be promptly instituted. Hot food and drink in copious quantities should be available. These patients should be placed on adequately heated wards, under a sufficient number of blankets. Most should be given barbiturate sedation by mouth (see below).

2. *Alleviation of deprivations.*—Patients should be given a clean change of clothing, a hot shower, and a chance to shave. Reading and writing materials should be at hand. Patients should be provided with such personal items as toothbrushes, shaving and other toilet equipment, and cigarettes. Welfare problems will be acute. Families will be scattered and separated. Patients will have lost their housing and many will have lost all their possessions. Red Cross and social work counseling and welfare services must therefore help these persons to adjust to their losses, securing information of personal nature, and performing other services of a welfare nature. Hospital chaplains should be available for those who urgently need religious support.

3. *Psychotherapy.*

a. *The patient-physician relationship and history-taking.*—The psychiatrist should combine respect and sympathy for the patient with

an attitude of firmness, realism, and decisiveness. The aim should be to allow no doubt to arise in the patient's mind that he is expected to regain relative emotional health rapidly and return to the community and his family to fulfill his role and duties. Within this context, the patient should be encouraged to tell his story. He should be "heard out." No matter what the pressure of the situation, the psychiatrist should avoid giving the patient the impression of having received a "brush-off." On the other hand, because of the highly suggestible state of these patients, leading questions should be avoided. If physical complaints are present, the organ system concerned should be carefully examined.

b. *Ventilation.*—Allowing these patients to tell their stories, and ventilate their fears, hopes, and resentments will frequently bring marked symptomatic relief. During such ventilation, the psychiatrist should remain as passive as practicable. In this way, it will frequently be possible for patients to formulate and work through their problems with a minimum of direction.

c. *Strengthening of group loyalties and identification.*—Victims of civilian disaster, like combat soldiers, will be supported in large part by group loyalties and sense of duty. Wavering persons should be helped to endure their misfortunes by invoking and strengthening these forces. In properly chosen cases, the psychiatrist should not hesitate to call on the patient's loyalties to his family, neighbors, and immediate working group. Calls on loyalties to larger groups such as the nation, may perhaps be less effective.

d. *Suggestion.*—Treatment should *(1)* avoid suggestion of illness and *(2)* employ positive suggestion to remove or alleviate symptoms.

Psychiatric treatment facilities will need and should have a minimum of the atmosphere of a conventional hospital. As much as possible, consistent with their medical mission, they should resemble ordinary centers for the reception of persons rendered homeless by the disaster. Except in the coldest of winter months, in the absence of available buildings, adequately heated tents will constitute acceptable facilities. Folding canvas cots would be acceptable in lieu of beds. Mattresses and sheets would not be necessary. There will be few persons who would be psychotic, or require care on a closed ward. Therefore special security features for the installations handling the psychiatric casualties of a civilian disaster would be unnecessary.

Patients should remain ambulatory, and should not be waited on. All possible steps should be taken to engender in the patient an expectation of early recovery. The psychiatrist should maintain an attitude of firm kindliness, avoiding undue sympathy or overconcern. The examiner should employ neutral speech terms, avoiding leading questions, and allowing the patient to tell his story in his own way, thus devel-

oping a full and complete story of the present illness. By making the appropriate systemic examinations promptly and avoiding unnecessary referrals for special examinations, consultations, laboratory and x-ray work, the psychiatrist will avoid suggestion of physical and psychiatric disability. Indecision, unnecessary referrals and "buck-passing" by unnecessary diagnostic procedures tend to fix the attitude of illness and invalidism in patients by suggestion and by increasing the secondary gain of illness. In the same way, unnecessarily long stays in a hospital would tend to suggest continued and perhaps undiagnosed illness to the patient and should be avoided.

In the proper cases, suggestion should be used in a specifically directed manner to eliminate hysterical symptoms such as tics and paraplegias. Used alone, however, it does not alter basic psychopathology, and the symptom is likely to recur, or be replaced by another symptom or by a wave of anxiety. Therefore, it is best combined with technics for uncovering repressed material, with abreaction, and manipulation of secondary gain. When thus used in combination with other tools, suggestion can be of great therapeutic value.

e. *Uncovering therapy.*—In a significant portion of cases, patients probably will exhibit amnesia for certain of the events associated with the disaster. Firm suggestion by the examiner that the patient can now recall his forgotten experiences may result in recovery of this material. In general, however, nonmanipulative technics for recovery of repressed material will be too time-consuming, and technics using intravenous barbiturates (narcoanalysis or narcosynthesis) or hypnosis will be indicated. These technics would be indicated in almost all hysterical reactions, with or without complete binding of anxiety. Patients with paralyses, tics, and hemitremors are almost certain to exhibit satisfactory results. Gratifying therapeutic results are also likely to be achieved in tense patients with retarded anxiety states in which a period of amnesia exists for traumatic events associated with the disaster.

f. *Reassurance.*—Because these patients will tend to be easily convinced that they are seriously ill, it will be important to reassure them decisively, after proper examination, that no serious physical illness exists. The patient also should be reassured concerning the magnitude of his psychiatric disability. In appropriate cases it should be stressed that the reaction, being situational, will be short-lived and should have no effect on the patient's permanent mental and emotional health, ability to work, or social or marital adjustment. It should be stressed that the reaction has no relationship to insanity. In general, matters should be placed in their proper realistic proportions. On the other hand, empty expressions of confidence should be avoided.

g. *Explanation.*—Many patients will derive great benefit from an understanding of the cause of their symptoms. An explanation of

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the normal fear reaction, with its psychologic and somatic symptom complex, will aid many of them.

h. *Manipulation of secondary gain.*—As in military psychiatry, it is probable that the secondary gain of neurotic illness will be an important factor in causing and perpetuating psychiatric disabilities after a disaster involving civilians. Illness will tend to "pay off" by removing the patient from discomfort and possible danger and placing him in the relative ease and safety of a medical installation. Psychiatrists should attempt to neutralize this factor to the greatest extent practicable.

i. *Sedation* should be individualized. On admission, each patient should be seen briefly for a screening interview. Tense and anxious patients, evacuated from the disaster scene only minutes or hours before, should be given adequate sedation. This will have as its aim the production of one full night's sleep. From 0.4 to 0.6 gram of amobarbital sodium or its equivalent in pentobarbital should be given. In certain patients, sedation should be continued throughout the following day, using 0.2 gram of amobarbital sodium q. i. d. or its equivalent. Continuous heavy sedation should not be employed in most cases because it tends to produce barbiturate intoxication and produce or heighten disorientation. No further medication should be given to patients who have received adequate sedation elsewhere. Sedative medication should usually not be given to persons who have experienced only minimal stress. Except occasionally in managing psychotics, intravenous sedation will be seldom advisable.

j. *Measures designed to restore orientation.*—In certain severe anxiety reactions with panic and confusion, the primary therapeutic task will be to restore proper orientation and contact. These patients (termed "pseudopsychotics" by military psychiatrists during World War II) will be "stuck" in their disaster experience. They will call out, cower, and express fear and rage appropriate to that situation. Combat psychiatrists found that sedation of such patients heightened their disorientation. Consequently, sedative medication of any kind for them should be avoided. Instead, special nursing should be instituted, with primary emphasis devoted to restoring orientation and contact by engaging the patient in conversation.

k. *Work therapy.*—One of the most important psychologic needs of these patients will be to be engaged in useful work. They should be given useful tasks around the hospital to the greatest extent practicable. They should aid in housekeeping duties around their ward. Formal occupational therapy of the arts and crafts type should be avoided. Complete recovery will be hastened by rapid discharge from the hospital so that patients may return to useful community and family roles. There, treated as normal persons expected to do a normal day's work, most of them will improve rapidly.

1. *Manipulation of group mechanisms.*—It will be important to avoid weakening the patients' identification with family and community. Accordingly, it will be important to hospitalize them as close to their homes and the scene of the disaster as is practicable. Hospitalization should be short, and the emphasis should be on returning them to family and community responsibilities as rapidly as possible. There should be active information and orientation programs to promote continued identification with the war effort and the interests of the community and nation.

## SUMMARY

In the event of an atomic attack on a civil population, there may be widespread panic among the people in the affected area unless there is adequate planning for the prevention and control of panic behavior. The following are among the major causes of panic: tension and insecurity, imitative behavior, suggestibility, rumor, fear of the unknown, lack of preparation and training, and stressful sensory stimuli.

Although men, as single persons or in groups, break down or disintegrate in direct ratio to the duration and intensity of stress, little is known of the factors that enable persons or groups of people to endure stress and continue productivity. Among the more important supporting factors are leadership, group identification and group solidarities, strong motivations, and the presence of incentives. The absence of community organization, education in principles of mental health, and factual orientation in the situation to be faced may add immeasurably to the impact of the stress. Contributing stresses or supports lie in family life, religious practices, educational systems, industrial practices, social customs, and group tensions.

Treatment of psychiatric casualties of a civilian disaster caused by an enemy attack should be carefully planned to reinforce constructive group and social mechanisms. Emphasis should be placed on (1) preserving the patient's identification with his community, job, and family, (2) minimizing the secondary gain of neurotic illness, and (3) avoiding suggestions of illness and disability. To this end, provision should be made for carefully controlled screening, treatment and evacuation of psychiatric patients. Hospitalization should be afforded as close to the scene of the disaster as possible, and should be short. There should be provision for treatment of effects of fatigue and exposure. Adequate sedation will be necessary for many patients. Psychotherapy for most patients will be brief. The attitudes of the psychiatrist and the absence of a hospital atmosphere in the treatment installations should promote expectation of rapid recovery.

# Modern Burn Therapy[1]

Stephen H. Tolins, *Commander, MC, U. S. N.* [2]

THE treatment of burns has been a controversial subject for many years. A few simple definitions and considerations are therefore in order. The simplest classification of burns is that which divides them into first, second, and third degree, according to the depth of the burn. A first degree burn is a simple erythema of the skin. A second degree burn is a partial destruction of the skin with viable epithelial elements persisting. This is characterized by blebs, bullas, oozing of plasma, and areas of visible pink corium. A third degree burn is one that destroys the full thickness of the skin and sometimes the underlying tissues down to and including the bone. This is sometimes distinguishable by dry, hard, dead, white skin, firm or leathery to the touch, or by a charred appearance.

Besides the depth of the burn, important considerations are the region, the extent, and the duration of the burn. The region of the burn is of importance because of the greater susceptibility of the flexion crease areas to infection and the functional importance of such areas as the hands, elbows, and other joints. The extent of the body surface area involved directly influences the general systemic reaction which we see as the so-called burn shock, and therefore directly influences our immediate treatment of the patient as a whole. Most of the early formulas for the administration of fluids intravenously to the severely burned person were based on the percent of the body surface which was burned. Harkins [3] has stated that a severe burn greater in extent than 15 percent of the total body surface in adults and 10 percent in the very young and the very old will produce shock.

The Berkow [4] formula for the estimation of skin area assumes, therefore, prime importance (table 1). In very young children and infants the head area is greater proportionally than in adults and the

[1] Received for publication 5 October 1950.

[2] Surgical Service, U. S. Naval Hospital, Portsmouth, Va., when this article was written.

[3] Harkins, H. W.: The Treatment of Burns. Charles C Thomas, Publisher, Springfield, Ill., 1942.

[4] Berkow, S. G.: Method of estimating extensiveness of lesions (burns and scalds) based on surface area proportions. Arch. Surg. 8: 138-148, Jan. 1924.

thigh area less, otherwise the proportions are the same in infants and in adults. Allen and Koch (5) named five main points or steps in the treatment of the burned patient:

1. Prevent and combat shock.
2. Convert the open, contaminated wound into a clean wound.
3. Cover the wound with a simple dressing that: (a) protects it from constant danger of reinfection, (b) does not fix or destroy any part of the skin that remains viable, (c) provides for drainage of the serum that exudes from the burned surface, and (d) exerts a uniform, moderate pressure easily removed if infection develops.
4. Keep the injured part at rest.
5. Secure healing in a minimal period of time and with a minimal loss of function.

Point 1 covers the immediate general care of the patient and the maintenance of his nutritional state. The remaining 4 points deal with the local care of the burn itself.

TABLE 1.—*Berkow's skin area formula*

| *Region* | *Percent of body surface* |
|---|---|
| Head and neck | 6 |
| Upper extremities | 18 |
| Hands | 4.5 |
| Arms and forearms | 13.5 |
| Trunk | 38 |
| Anterior | 18 |
| Posterior | 20 |
| Lower extremities | 38 |
| Thighs | 18 |
| Legs | 13.7 |
| Feet | 6.3 |

## GENERAL CARE

Burn shock is caused directly by a decrease in the total circulating blood volume, which in turn is caused by the loss of plasma, resulting in marked hemoconcentration. The plasma is lost not only by exudation from the burned surface, but also by edema into the tissues surrounding the burned area. This expansion of the interstitial fluid volume takes place in the first 36 to 48 hours, dehydrates the cells, and can lead to renal failure. The external loss of fluid is minor compared to the pooling of lymph in the edematous area of the burn. The expansion of the interstitial fluid volume caused by the edema is proportional to the area burned. The proportion is not direct, however, as the expansion has usually reached its maximum of 50 percent above the normal in burns involving more than 30 percent of the body surface. The period immediately following the burn is one of great importance. Two-thirds

(5) Allen, H. S., and Koch, S. L.: Treatment of patients with severe burns. Surg., Gynec. & Obst. 74: 914-924, May 1942.

to three-quarters of deaths from burns occur in the first 48 hours, as a result of severe and irreversible shock rather than any toxin, the release of which is still purely hypothetical. Replacement therapy must be instituted promptly and according to a plan which will replace adequately the expected loss and prevent the occurrence of shock. Various formulas for the giving of plasma have been devised. Harkins *(3)* has recommended 100 cc. of plasma for every point of hematocrit above 45, 40 cc. of plasma for every point of hemoglobin above 100, or 100 cc. of plasma for every percent of body surface severely burned. Elkinton, Wolff, and Lee *(6)* have pointed out that a 20 percent reduction in plasma volume can occur within 15 minutes after a burn of 20 percent of the body surface. Rhoads et al. *(7)* stated that a burn of moderate severity such as of a single extremity will cause a plasma loss of 1,400 cc. in 6 to 12 hours.

Cope and Moore *(8)* in an extensive work on fluid therapy and the redistribution of body water in burns evolved a formula based on the anticipated interstitial space expansion. They pointed out that the administration of fluid by the surface area formula does not take into account the variation in the volume of edema according to the particular body area burned, the depth of the burn, the relocation of fluid from burned to unburned areas, nor the overloading of area lymphatic trunks by multiple small burned areas. For a patient with a burn of more than 30 percent of his surface area, their formula for the first 48 hours provides replacement of fluid for the following avenues of loss: (1) for wound edema, a volume equal to 10 percent of the body weight; (2) for external loss, 1,000 cc. for a burn of 25 to 35 percent of the surface area, 2,000 cc. for a burn of 35 to 60 percent, and 3,000 cc. for a burn of over 60 percent; (3) for renal excretion, 1,500 cc. per 24 hours, half as normal saline solution and half as dextrose in water; and (4) for insensible loss, 1,500 cc. for 24 hours as dextrose in water.

The values for 1 and 2 are to be added and two-thirds of the total given as plasma or blood, the remaining third as normal saline solution. Instead of normal saline solution a combination of 2 parts normal saline solution and 1 part 1 percent sodium lactate solution has been recommended. This 48-hour ration should be divided in 4 parts, 2 parts to be given in the first 12 hours, 1 part in the second 12 hours, and the last part in the last 24 hours from the time of the burn (table 2).

The best check of the patient's condition during this critical period is the renal output. Cope and Moore *(8)* advise the insertion of an indwelling catheter in the seriously burned patient and a check of the hourly urine flow. This should be between 50 and 200 cc. They point

*(6)* Elkinton, J. R.; Wolff, W. A.; and Lee, W. E.: Plasma transfusion in treatment of fluid shift in severe burns. Ann. Surg. *112*: 150-157, July 1940.

*(7)* Rhoads, J. E.; Wolff, W. A.; Saltonstall, H.; and Lee, W. E.: Use of plasma in treatment of shock due to burns. Clinics *1*: 37-42, June 1942.

*(8)* Cope, O., and Moore, F. D.: Redistribution of body water and fluid therapy of burned patient. Ann. Surg. *126*: 1010-1045, Dec. 1947.

out that although serial hematocrit and hemoglobin determinations are of great value, they do not promptly reflect the rapidly changing conditions. The hourly urine however will give a prompt indication of the adequacy of treatment. If the hourly urine output remains low, the therapy may be inadequate or a renal lesion may already be present. They then advocate a water tolerance test. From 1,000 to 1,500 cc. of 5 percent dextrose in water is given intravenously in from 40 to 60 minutes. If the urine output then rises, previous therapy was inadequate. If there is no urinary response, then a renal lesion is present, and therapy must be altered to take this into account. Not more than from 1,500 to 2,000 cc. should be given daily to replace insensible loss. They maintain that this so-called water tolerance test will not further embarrass an already damaged kidney nor greatly influence the amount of edema.

TABLE 2.—*Plan of fluid therapy for man weighing 70 Kg. with burn of 40 percent of his surface area*

| | cc. |
|---|---|
| For wound edema 10 percent of body weight | 7,000 |
| For external loss in a burn of 40 percent of surface area | 2,000 |
| For renal excretion for 48 hours | 3,000 |
| For insensible loss for 48 hours | 3,000 |
| Total fluid for 48 hours | 15,000 |
| Given as: | |
| Blood (and/or plasma) | 6,000 |
| Normal saline solution (or 2 parts normal saline solution with 1 part 1 percent sodium lacate solution) | 4,500 |
| 5 percent dextrose in water | 4,500 |

Administration: in 4 parts: for first 12 hours, 2 parts; for second 12 hours, 1 part; for second 24 hours, 1 part.

Many authors in recent years have pointed out the rationale of using whole blood as a replacement therapy. Moyer et al. *(9)* showed repeatedly that a dog with a burn of 80 percent of his surface area treated with salt solution orally and blood intravenously survived longer than a dog treated with plasma. Furthermore such a dog did not develop anemia during convalescence. Abbott et al. *(10)* maintained that the intravenous use of whole blood will not cause a hemoconcentration if saline solu- is given orally and in sufficient quantities or together with the blood intravenously. He stated that only if the hematocrit is above 60 should plasma be given rather than whole blood. Evans and Bigger *(11)* stated that there may be up to a 40 percent deficit in the erythrocyte mass shortly after a severe burn.

*(9)* Moyer, C. A.; Coller, F. A.; Iob, L. V.; Vaughan, H. H.; and Marty, D.: Study of interrelationship of salt solutions, serum and defibrinated blood in treatment of severely scalded, anesthetized dogs. Ann. Surg. *120*: 367-376, Sept. 1944.

*(10)* Abbott, W. E.; Pilling, M. A.; Griffin, G. E.; Hirshfeld, J. W.; and Meyer, F. L.: Metabolic alterations following thermal burns; use of whole blood and electrolyte solution in treatment of burned patients. Ann. Surg. *122*: 678-692, Oct. 1945.

*(11)* Evans, E. I., and Bigger, I. A.: Rationale of whole blood therapy in severe burns; clinical study. Ann. Surg. *122*: 693-705, Oct. 1945.

Moore et al. *(12)* studied the erythrocyte mass and the bone marrow activity in severely burned patients by means of radioactive iron and measurements of the pigment excretion. They stated that a patient with a full-thickness burn of 10 percent or more of the body surface will develop a significant anemia. Four of their patients were given at least 16,000 cc. of whole blood in from 40 to 60 days but still left the hospital with an anemia after all burns were healed. They listed the following causes for this burn anemia: (1) initial hemolysis in the burn site, (2) the effect of un-neutralized plasma antibodies, (3) depression of bone marrow and (4) and in the later stages, after the first 2 weeks, hemorrhage from the granulating surface and blood loss caused by infection. They showed that a simple change of dressing can cause a loss of several hundred cubic centimeters of blood, and the procedure of cutting away slough and grafting may cause a loss of up to 2,000 cc.

They also pointed out that impaired gastrointestinal function and liver function may lessen iron absorption and hemoglobin synthesis. Evans and Bigger *(11)* also pointed out that plasma protein levels do not fall with whole blood therapy as they do with plasma therapy, which they thought might result from maintaining the liver in a better state. They stated that the giving of whole blood in the presence of hemoconcentration did not produce any cases of thrombosis. Thus, although plasma therapy will prevent and combat the shock, the use of whole blood is preferable because it prevents the occurrence of anemia and hypoproteinemia. This maintenance of a good nutritional state and high red blood cell and hemoglobin levels is of great importance in the course of treatment of the burn itself, especially for prompt grafting and good final results. An adequate diet rich in protein and vitamins, especially vitamins C and B complex is important.

## LOCAL CARE

Harkins *(3)* listed about 50 methods for the local treatment of burns at the time when the then-popular treatment, tanning, was falling into disrepute. The use of tannic acid was shown to have an influence in producing liver necrosis. Boric acid solution or ointment was shown to be toxic, and in 1944 an editorial in the Journal of the American Medical Association came out strongly against tanning. The Surgeon General of the Army in March 1945 published a circular letter which prohibited the use of the coagulation method.

The present method of local care is simple. The burned area should be gently cleansed with plain white soap and warm water, using only cotton as a brush. This should be done for about 10 minutes. Often this can be accomplished without the use of general anesthesia. This procedure must be carried out in the operating room with the surgeon and

*(12)* Moore, F. D.; Peacock, W. C.; Blakely, E.; and Cope, O.: Anemia of thermal burns. Ann. Surg. *124*: 811-839, Nov. 1946.

assistants gowned, masked, and gloved as for any surgical operation. After the cleansing of the burned area, a single layer of sterile, fine-mesh gauze or vaseline gauze is applied. This is covered with a thick layer of mechanic's waste or fluffed gauze and a layer of pads, and an ace bandage is applied to give gentle even pressure. Improperly applied pressure produces ischemia. Extremities should be bandaged from the extreme distal tip proximally as far as necessary. Fingers and toes should always be separately wrapped to prevent agglutination of opposing granulating surfaces. The hand should be placed in a position of function and involved joints should be further put at rest by the use of splints.

The initial redressing should not be done before at least 8 days have elapsed unless there are evidences of marked infection, such as temperature elevation, foul odor of the dressings, pain at the burned site, or marked discharge soaking the dressings. This redressing must be done in the operating room, observing sterile technic. At the time of this redressing the exact extent of second and third degree burns can be ascertained. Superficial second degree burns will be almost completely healed at this time. Deeper second degree burns will be noted and can be redressed with the expectation that they will be healed in another 1 or 2 weeks. The real problem in local care is presented by the third degree or full-thickness burns. The sooner such burns are completely covered with skin the better will be the end result cosmetically and functionally.

The chief cause for delay in early grafting is the continued presence of a thick slough on the surface of the burn. If this is left to separate spontaneously many weeks will be lost. The chief problem, then, is the means by which this slough may be separated. The principal means by which this separation of the slough may be accomplished are: (1) the application of pyruvic acid paste as advocated by Connor and Harvey *(13)*; (2) surgical excision; and (3) wet dressings, using Dakin's, saline, or some other type of solution.

Connor and Harvey stated that, with the use of their pyruvic acid paste the slough can be separated and the surface ready for grafting in from 10 to 14 days. The disadvantages of this method are: (1) the necessity of frequent dressing, (2) the pain produced by the paste, (3) the production of an inflammatory base of granulations, (4) the instability of the paste, and (5) the large amounts of paste necessary for large surface areas. Surgical excision has many advocates. Cope et al. *(14)* favor immediate excision and grafting of the full-thickness burn. This is not always feasible because of the difficulty in distinguishing between the second and third degree burns. Also, where

*(13)* Connor, G. J., and Harvey, S. C.: Pyruvic acid method in deep clinical burns. Ann. Surg. *124*: 799-810, Nov. 1946.

*(14)* Cope, O.; Langohr, J. L.; Moore, F. D.; and Webster, R. C., Jr.: Expeditious care of full-thickness burn wounds by surgical excision and grafting. Ann. Surg. *125*: 1-22, Jan. 1947.

large burns are involved, the condition of the patient is such that extensive operative procedures cannot be tolerated. This method of immediate excision and grafting is useful only in treating small circumscribed deep burns, the limits of which can be definitely distinguished.

Allen and Koch *(5)* recommend surgical excision of the slough after the first redressing, at which time the limits of the third degree burns are definite and the general condition of the patient has been improved to the point where good take of the graft can be expected. The excision and grafting may be performed as a single operation or, in the case of extensive burns, the slough may be removed, the wound redressed, and the grafting performed 2 or 3 days later. The importance of blood replacement therapy at this time must not be overlooked. Most third degree burns, if not grafted early, will become superficially infected in spite of antibiotic therapy which should be given to all burned patients. The wet dressing technic is most useful in treating these infected patients. Allen *(15)* advocated daily dressings using Dakin's solution.

The disadvantages of this technic are the pain, danger of reinfection, and the increased blood loss occasioned by repeatedly changing the dressing. The incorporation of catheters into the bulky pressure dressing, which has as its initial layer fine-mesh gauze obviates these disadvantages. Through these catheters a solution of choice can be injected at regular intervals, maintaining the moist dressing and necessitating a change of dressing only every 6 to 8 days. A solution which we have found effective in combating infection while not destroying the growing epithelium contains 0.5 percent acetic acid and 15 percent glycerin in normal saline solution. This solution may also be used immediately after the grafts have been placed.

Split-thickness grafts taken either with the dermatome or with the Blair knife should be used. Most plastic surgeons condemn the use of the pinch graft. The thinner the split graft the more likely it is to take. Areas subjected to pressure, such as the sole of the foot and the palm of the hand, will require reoperation at a later date for the purpose of placing a full-thickness graft, but the later treatment of contraction deformities and burn scars is not part of the present discussion.

## SUMMARY

Shock must be prevented by a judicious use of blood and electrolyte solutions according to a definite plan such as the formula of Cope and Moore. The nutritional state must be maintained by high protein and vitamin intake. The local care of the burn should be limited to gentle cleansing with white soap and water followed by application of a vaseline-gauze pressure dressing. Proper positioning of extremities

*(15)* Allen, H. S.: Symposium on minor surgery; local treatment of whole thickness burn surface. S. Clin. North America 28: 125-133, Feb. 1948.

with splinting of joints must be accomplished. Initial redressing should be performed on the eighth to tenth day, followed by excision of the slough and skin grafting in the second week. To prepare the surface for grafting in the presence of infection, moist dressings, using an acetic acid and glycerin solution injected through catheters incorporated in the dressing, should be used.

# Survival After Almost Complete Body Surface Burn[1]

## Relation to Newer Concepts of Treatment and Report of a Case

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A. W. Bronwell, *M. D.* (3)

THIS case is being reported (1) because of the survival of a person with a 90 to 95 percent body burn; (2) to advocate and support the recent physiologic trends in the use of whole blood early and in adequate amounts, in spite of hemoconcentration and the feared complications of giving blood in its presence; and (3) to summarize the newer, more logical concept of treatment of burns.

### CASE REPORT

This patient was first seen in the morning on 27 January 1950 about 30 minutes following the explosion of a butane stove. He was given first aid consisting of 15 mg. of morphine and was then brought to the hospital. At the time of admission he was in severe shock. He was burned over his entire body except for: (1) an area about 3 cm. in diameter located beneath his chin, (2) an area on the medial surface of both legs about 2 inches in width extending from the thigh to the heel, (3) the soles of the feet, and (4) part of the scalp. The affected area of the body was covered with first and second degree burns except that third degree burns involved 10 percent of his back, 50 percent of his hands, and both of his ears. Thus third degree burns covered about 10 percent of his body. The percent of the body surface burned was computed by Berkow's method which is shown in table 1.

He was immediately given another 15 mg. of morphine and was taken to the operating room where 500 cc. of plasma was given. He was dressed with a pressure dressing of nitrofurazone ointment. No attempt was made to debride or clean the wound. As soon as the patient

(1) Received for publication 3 October 1950.
(2) Reese Air Force Base, Lubbock, Tex.
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reached his room, a catheter was placed in his bladder in order to measure his daily and hourly urinary output.

TABLE 1

| Surface Area | Normal percent of whole body surface | Percent of body surface of burn of this patient |
|---|---|---|
| Head | 6 | 4 |
| Arms and forearms | 13.5 | 13.5 |
| Hands | 4.5 | 4.5 |
| Anterior surface of trunk | 20 | 20 |
| Posterior surface of trunk | 18 | 18 |
| Thighs | 19 | 17 |
| Legs | 13 | 11 |
| Feet | 6 | 4 |
| Total | 100 | 92 |

At the time of admission his erythrocyte count was 4,960,000 with 96 percent hemoglobin. His leukocyte count was 17,000 with 64 percent neutrophils and 36 percent lymphocytes. His hematocrit was 49. Because the morphine which he had received did not relieve his pain he was given 1,000 cc. of 0.1 percent procaine in 5 percent dextrose aqueous solution. It was hoped that this might also prevent any spasm of the capillary tufts of the renal glomeruli. The results were spectacular in that the patient was immediately relieved of his pain and did not require any further sedation for the next 24 hours. He received 1,375 cc. of whole blood in the first 24 hours. In addition to the above, he was given 1,000 cc. of 5 percent dextrose in normal saline solution intravenously. Besides other fluids, he was also given one-sixth molar sodium lactate solution by mouth. His oral fluid intake was 2,360 cc. His total fluid intake for the first 24 hours was 6,235 cc. He did not vomit at any time during his stay in the hospital. His 24-hour fluid output was 1,025 cc. His temperature was 104° F. on admission and dropped to 99.8° F. the following morning. A booster dose of tetanus toxoid was administered immediately, and 1 gram of ascorbic acid was added to the intravenous medication. He also received 300,000 units of procaine penicillin and 100,000 units of crystalline penicillin G every 12 hours, and 1 ampule of intravenous vitamin B complex and vitamin C. He was given 24-hour continuous special nursing care. In the afternoon his hematocrit reading was 57 and his erythrocyte count was 5,410,000 with a hemoglobin of 102 percent. The color index was 0.9.

On the morning of 28 January his erythrocyte count was 5,620,000 with 102 percent hemoglobin and his hematocrit was 56. That afternoon his erythrocyte count rose to 6,200,000; his hemoglobin was 106 percent; and his hematocrit was 61. During the second 24 hours, he received 500 cc. of whole blood, 500 cc. of plasma, Ringer's lactate solution orally, and a high protein, high caloric, and high vitamin diet. His total fluid intake on this date was 4,450 cc. His total output of urine was 3,020 cc. At this point it was believed that the shift of

fluids from the extracellular compartments to the intravascular system was taking place because of the high urinary output. This was substantiated the following morning by the fact that his erythrocyte count dropped from 6,200,000 to 4,790,000; his hemoglobin from 106 to 100 percent; and his hematocrit from 61 to 55. His temperature on the second day ranged from 99 to 101° F. From this day to his tenth hospital day, he was given 1 cc. of pyridoxine, 1 ampule of vitamin B complex, and 500 mg. vitamin C twice a day intravenously. One vitamin B complex capsule and 200 mg. ascorbic acid orally three times a day was added. The high vitamin, high caloric, and high protein diet was continued. The patient was also given 1 cc. of desoxycorticosterone acetate intramuscularly twice a day. Blood pressures could not be taken because of the burns.

On 29 January the patient was given 500 cc. of whole blood and 1,000 cc. of 5 percent dextrose in distilled water. On this date his fluid intake was 5,490 cc. and his fluid output was 2,320 cc. He craved salt water and drank normal saline solution instead of water. His temperature ranged between 99.2 and 103° F. on this date. Demerol replaced morphine, and he was given 250 mg. of aureomycin 6 times a day, because of temperature elevation in spite of the fact that he was receiving 600,000 units of procaine penicillin and 200,000 units of crystalline penicillin G daily. Aspirin was given to reduce the temperature when it was above 103° F.

On 30 January his erythrocyte count was 5,670,000, with 114 percent hemoglobin, and a hematocrit of 56. On this date his fluid intake, which consisted of water, saline solution, and milk reinforced by protein hydrolysate, was 5,695 cc. taken orally. His fluid output on this date was 3,210 cc. His temperature dropped, ranging from 99.6 to 101.6° F. A multivitamin capsule, 3 times a day, was added to the above regimen. Demerol was no longer necessary. Phenobarbital sodium was then given for sedation with the resulting sad experience that the patient lapsed into a semicomatose stage with a stertorous type of respiration and was difficult to arouse. He remained in this condition for about 12 hours. No further sedation was needed except when his dressings were changed. His temperature range on this day was between 99.6 and 101.6° F.

On 31 January his erythrocyte count was 4,950,000; his hemoglobin was 100 percent with a hematocrit of 53. His temperature ranged from 99.8 to 100.2° F. His fluid intake on this day was 6,200 cc. and his output was 2,320 cc. All of this intake was by mouth. On 1 February his erythrocyte count was 5,360,000; hemoglobin 100 percent; and hematocrit 52. His fluid intake was 5,725 cc. and his output was 2,325 cc. His temperature ranged between 99 and 100° F.

On 2 February his erythrocyte count was 4,940,000 with a hemoglobin of 92 percent and a hematocrit of 48. He was given 500 cc. of whole blood. The catheter was removed, and he began to void spontaneously.

His urinary output was 1,500 cc. and his fluid intake was 4,000 cc. On this date an accurate check of his fluid intake and output was discontinued except to note that he passed over 1,500 cc. of urine daily. At this time, the dressings became so loose that we were unable to maintain them in position, and it became necessary to change them. He was redressed with a pressure dressing of nitrofurazone ointment. Following this dressing, his temperature rose to 103° F. It continued to rise on the eighth day, fluctuating between 99.6 and 104.2° F.

His erythrocyte count on 3 February was 6,280,000 with a hemoglobin of 98 percent, and a hematocrit of 54. On 4 February his red blood cell count was 5,480,000; hemoglobin 108 percent; and hematocrit 49. His temperature dropped to 100° F. and ranged between 100 and 101° F. On the following day his temperature was 100° F. The only abnormal elements in the urinalyses were the persistence of red blood cells, and an occasional leukocyte. His general condition was excellent and he was apparently making a satisfactory recovery. His urinalyses showed a progressively decreasing number of red blood cells until 9 February, at which time the urine was entirely normal and continued to be so until his discharge from the hospital. The hematocrit dropped from 46 to 42 by the twelfth day. His erythrocyte count stayed between 4,300,000 and 5,000,000 and the hemoglobin varied between 13 and 16 grams. His temperature, except for a rise to 100.6° F. on 8 February, remained normal. This elevation of temperature occurred when he was given 0.1 gm. of seconal, which was followed by chills, sweating, tachycardia, stertorous breathing with 38 respirations per min., and a semicomatose condition with occasional cyanosis which required oxygen for its relief. This lasted for 24 hours after which the patient became alert, began to eat, and to react normally. His respirations were shallow during this period also and he complained of choking. Thirteen days after his burn, the right arm was healed. His dressings were changed 14 days after the accident because they had become loose again. Nitrofurazone ointment covered by vaseline gauze was used. The crusting lesions of the face were being cared for with saline solution and vaseline. Figures 1 and 2 show the condition of the patient's lesions on the fourteenth day. Eighteen days following the accident all the areas were healed except for his ears and his left foot. These areas required further dressings. The patient was encouraged to move all joints, especially the fingers and hands from the beginning. Physiotherapy was added later and the patient recovered without limitation of motion in any joint. He began to gain weight 24 days after his injury and continued to gain thereafter until he reached his normal weight. Thirty-four days after the accident, all areas were healed and the patient was returned to light work.

This patient's wife, who was 6 months pregnant, sustained burns of about 40 percent of her body surface in the same accident. She was treated in the same way, recovered, and delivered a normal 8½-lb. baby.

*Figure 1.—Photograph taken 14 days after accident.*

Later three other patients with burns covering more than 70 percent of the body surface were similarly treated and fully recovered.

Based on a review of the literature combined with our own experience we have summarized the treatment of burns which we believe will give the best results. In the past, most of the attention has been centered on the local treatment of burns, but in recent years a shift of interest to the physiologic aspect of burn treatment has greatly improved prognosis.

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*Figure 2.—Some of the lesions on the fourteenth day.*

## PRINCIPLES OF TREATMENT

1. *Emergency treatment.*—Immediate draping of the patient in sterile or clean sheets if at all possible. Morphine should be given intravenously immediately because of its rapid and nonaccumulative action. The dose should be 10 mg. intravenously. This can be repeated as often as pain dictates. Morphine given subcutaneously is often ineffective because the patient's shock results in poor peripheral circulation, hence delayed absorption of the drug. This is often repeated once or twice by the unwary, resulting in cumulative action or overdosage when the shock is controlled. Morphine can be repeated at intervals intravenously when its effect wears off without danger of cumulative action. Intravenous procaine is of great value in allaying pain and discomfort when morphine is either ineffective or contraindicated. It may also be a good prophylactic measure against anuria.

2. *Admission to a hospital where adequate facilities are available.*

3. *Pressure dressings* should be applied without any debridement or breaking of blebs while the patient is being prepared for transfusion. Many types of local applications are used and advocated by various authors. The method which the individual physician is accustomed to should be used. Because a patient with burns presents an ideal condition for thrombophlebitis or phlebothrombosis, such as (1) shock with decreased blood flow and lower venous pressure, (2) hemoconcentration with increased blood viscosity, (3) prolonged immobilization, (4) circular dressings, (5) intravenous injections, (6) sepsis, (7) edema, and (8) nutritional deficiencies, one must be especially careful to avoid any tourniquet effect with pressure dressings of the extremities. Pressure dressings, if applied too tightly about the chest and abdomen, may impede breathing and help produce atelectasis, pulmonary edema, and pulmonary congestion with resulting anoxemia. In hot weather massive pressure dressings may increase body temperature and discomfort.

4. *Tetanus toxoid or antitoxin* should be administered to all burned patients and prophylaxis against gas gangrene should be given if indicated.

5. *Whole blood transfusion* of 500 cc. or more should be given immediately. This should be repeated daily for 3 days and thereafter as indicated by (1) the blood picture and/or (2) the shift of fluids from the extracellular spaces to the intravascular system as shown by the increased urinary output and the fall in hematocrit. Whole blood is preferred to blood substitutes because: (1) it restores all deficits of circulating fluid volume better than any other single agent; (2) it contains nearly twice as much protein as plasma, thereby exacting a greater sparing action on body proteins; (3) in controlling shock it lessens the possibilities of anoxemic damage to the brain, liver, kidneys, and bone marrow; (4) it helps prevent toxemia; (5) there is less tendency to develop pulmonary edema than when large amounts of electrolytes and

plasma are given; (6) it stimulates the function and oxygen carrying capacity of the circulating red blood cells; (7) it replaces the circulating red blood cells lost through coagulation in the capillaries of the burned area, increased permeability of the capillaries, and red blood cell destruction by hemolysis and sepsis; (8) it stimulates red blood cell regeneration; (9) it prevents vomiting caused by a delayed emptying of the stomach which is frequently associated with an inadequate or lowered total blood volume; and (10) it prevents the anemias which frequently occur in the intermediate period.

Many physicians are afraid to give whole blood in hemoconcentration. These fears are exaggerated and empirical because a transfusion of blood with a hematocrit reading of 42 can only dilute a blood with a higher hematocrit reading. Early adequate treatment by whole blood transfusions will produce an earlier shift of the fluids from the extracellular compartments to the intravascular system. This is shown by increased urinary output and decrease in the hematocrit reading. The fear of giving whole blood in face of hemoconcentration is based on (1) increasing the viscosity of the circulating blood, (2) increasing the chances of phlebitis, thrombophlebitis, or phlebothrombosis, and (3) producing hemoglobinemia and hemoglobinuria with the possibility of hemoglobin crystallization in the kidney tubules. The recent literature does not show any increase in phlebitis, thrombophlebitis, or phlebothrombosis as the result of whole blood transfusions. According to the Cocoanut Grove experience, no kidney damage developed as a result of hemoglobinemia and hemoglobinuria. In the recent literature, we have not been able to find anything that contraindicates whole blood transfusions solely because of hemoconcentration.

6. *Electrolytes.*—As soon as the patient is admitted to his room, a catheter should be inserted in the bladder in order that the urinary output may be followed. The patient should have an output in the first 24 hours of about 1,000 cc. After this, one should maintain a urinary output above 1,500 cc. The electrolyte loss in the burned area consists of sodium bicarbonate and sodium chloride. If nausea and vomiting are present, lactated Ringer's solution should be given parenterally. In shock there is little absorption from the subcutaneous tissues, stomach, and intestinal tract until the blood flow is re-established. Therefore, lactated Ringer's solution should be given intravenously when shock is present. If there is no nausea or vomiting, fluids should be given by mouth. Two solutions can be used by this route. One is a mixture of one teaspoonful of sodium chloride and two-thirds of a teaspoon of sodium bicarbonate or citrate to one quart of water. The second is a one-sixth molar solution of sodium lactate. Sodium chloride alone should not be used since it might produce an acidosis. Two beneficial results are obtained from the use of sodium lactate: (1) quick control of acidosis, and (2) improvement of the urinary output. There should be no arbitrary rule as to the amount of electrolyte given. This should be

determined by the patient's response to blood, plasma, and electrolyte administration. However, 3 to 5 liters of fluid in the first 24 hours and 2 to 3 liters in the second 24 hours, as tolerated, seems to be reasonable. The urinary output should be the determining factor. These fluids do not prevent a metabolic acidosis (ketosis) which is likely to develop in burned or scalded children. Sugar is needed to prevent this and hard candy is a satisfactory source. No water is allowed by mouth until the shift of fluids from the extracellular compartment to the intravenous system has occurred, unless there are signs of water needs. These are: severe thirst, dry mucous membranes, rise in temperature, and plasma sodium concentration above 138 milli-equivalents per liter. The shift of the fluids is evidenced by: (1) increased urinary output, (2) fall in hematocrit and red blood cell count, and (3) subsidence of edema in the burned areas. At this stage, the bandages become loose. If salt solution is maintained after the shift has occurred, it will prolong the edema and interfere with healing. The huge amounts of fluids (10,000 to 15,000 cc. every 24 hours) advocated in earlier periods by some physicians seems excessive and may do more harm than good. Potassium and calcium deficiencies tend to develop later because of loss through granulations, especially if the patient does not eat enough at this stage. Whole or dried milk is a good source of calcium and meat, liver, and fish are a good source of potassium; therefore, the proteins of the diet should consist largely of milk and meat.

7. *Oxygen.*—In the treatment of shock, oxygen is indicated if there is any sign of respiratory embarrassment of anoxemia.

8. *Rapid mobilization of patient.*

9. *Diet.*—It is essential to give a high protein, high caloric, and high vitamin diet. The patient should have a protein intake of 200 to 400 grams a day, and carbohydrates in excess of 300 grams a day. This should be supplemented by adequate amounts of vitamin B complex and ascorbic acid given intravenously and, as soon as tolerated, with polyvitamins and ascorbic acid given by mouth. Various investigators have proved adrenal cortical extract to be of doubtful value, but we believe that it should be given so that the patient might have every advantage.

10. *Antibiotics* that are indicated should be given immediately and should be continued in sufficient amounts until the burn is healed.

11. *Skin grafting* should be performed as soon as possible.

# The Dental Aspects of Hemorrhage

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THE problem of hemorrhage in dental operations can be met by premedication, hemostasis during operation, and postoperative control measures. Because one of the chief causes of excessive hemorrhage in dental operations is an increased blood pressure at the time of operation, any of the barbiturates given from 20 to 30 minutes before the operation is helpful. These drugs cause a reduction in the patient's blood pressure, relieve undue anxiety, and slow the heart rate. Vitamin K may also be used preoperatively, particularly if the patient has a diminished prothrombin level. It should be given several days before the operation and continued at least 2 days afterward, especially if some of the salicylates are to be used as anodynes postoperatively. If serious hemorrhage is anticipated, a transfusion of 250 cc. of whole blood should be given about 1 hour preoperatively. In the case of a known hemophiliac, this procedure should be supplemented with an injection of the antihemophilic globulin fraction. The patient's general health should be brought to an optimal level preoperatively by the use of antibiotics, multivitamin therapy, proper diet, rest, and any of the other measures which may be indicated.

During the operation, it should be remembered that (1) clean-cut wound margins present less difficulty than ragged edges; (2) a few well-placed sutures can greatly aid in the control of hemorrhage from soft tissue; (3) the removal of all loose bone spicules eliminates one cause of secondary hemorrhage; (4) forcing the alveolus back into its former position after it has been sprung away will help close the bone vessels; and (5) puncture wounds made with small gage needles do not bleed as much as those made with larger needles. The control of dental hemorrhage during operation is greatly facilitated by the elevated position of the patient's head, and the use of epinephrine or some other vasoconstrictor in the local anesthetic. In spite of this, excessive bleeding sometimes occurs, and at such a time it must be kept in mind that all hemorrhage should be stopped with a minimum of trauma and with minimal foreign body inclusion.

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Should the hemorrhage be from bone, the bone should be burnished with a blunt instrument. If this is not sufficient to effect hemostasis, then the procedure may be augmented by burnishing one of the bone waxes into the hemorrhaging surface. Should the hemorrhage source be the gums, an attempt should be made to ligate the bleeder. Torsion or pressure from a hemostat may be sufficient to cause hemostasis. Even digital pressure over gauze may suffice, particularly if the hemorrhage is from a vein or a capillary.

Cautery is occasionally useful in the control of hemorrhage, especially when the affected site is deep and other means of hemostasis are difficult to effect. The heat should be kept to a minimum so that no charred tissue is left in the wound to act as a foreign body. The reaction of hemorrhage to temperature is interesting. Heat hastens coagulation, but because it produces vasodilation it may prolong the bleeding. Cold produces a temporary vasoconstriction which reduces the blood flow, but it usually increases the clotting time. Therefore, cold is usually applied to the general area of hemorrhage and heat to the immediate area.

If all the mechanical means of hemostasis prove unsuccessful, the operator can rely on such chemical agents as zinc chloride, silver nitrate, potassium permanganate, iron chloride, iron subsulfate, alum, and tannic acid which act by precipitating protein, thus hastening coagulation, and by contracting the tissues at the site of hemorrhage. Such vasoconstrictors as epinephrine, ephedrine, phenylephrine hydrochloride, cobefrine, and cotarnine phthalate may also be used in controlling the hemorrhage. Thromboplastic agents such as thrombin which accomplish hemostasis either by supplying to the blood some ingredient that is necessary for coagulation, or by rendering inert some anticoagulating substance in the blood, are important adjuncts to chemical hemostasis. The active principle of thrombin is now available as a potent sterile extract. Other thromboplastic agents such as whole blood, blood plasma, blood serum, thromboplastin, hemostatic globulin, fibrinogen, cephalin, and hemoplastin, are useful under certain conditions.

During the war the problem of hemostasis was further simplified by the development of such absorbable sponge materials as fibrin foam (from human blood), gel foam (from animal gelatin), and oxidized cellulose. These agents, which are well tolerated by the body's tissues and are absorbed completely in from 30 to 45 days, serve as carriers for hemostatic agents, as eliminators of dead space, and as hemostatic agents in themselves. These materials must be used under strictly aseptic conditions. This is particularly true of gel foam, since gelatin per se is an excellent culture medium. Oxidized cellulose is highly acid and will nullify the activity of neutral thrombin so, if the two are to be combined, the sponge should first be soaked in a 1 percent solution of sodium bicarbonate. For this reason fibrin foam is probably the material of choice.

Although certain miscellaneous agents such as the venom of the tiger snake or of the Russell's viper, rutin, and certain of the dyes such as Congo red, have been used successfully for the control of dental hemorrhage, most operators prefer the better known methods. It must be remembered that primary hemorrhage is neither an undesirable nor abnormal occurrence, and that it can usually be easily controlled by some simple means such as biting pressure over sterile gauze.

The most severe, abnormal primary hemorrhages occur in hemophiliacs. White and Mallett (2) have devised a satisfactory method of operating on such patients, and have practiced it without fatality since 1928. They make impressions of both jaws in some soft, nonirritating colloid substance, and articulate the models made therefrom. The tooth to be extracted is then removed from the cast, care being taken not to touch the surrounding gingiva or the socket. An outline similar to that of a partial denture is then made, including a simple single wire clasp on either side, and with a saddle covering the entire socket and area adjacent to the tooth to be extracted. A splint of pink acrylic is then constructed, the operator making sure that it is not in contact with the teeth in the opposing arch. This splint should be entirely passive and should exert no pressure on the socket. The purpose of the splint is to protect the wound from the mechanical action of the tongue and food, and to hold hemostatic materials in the socket.

A small, orthodontic type of elastic band is then placed around the tooth to be extracted, and tucked into the gingival crevice. After several days, if this has disappeared beneath the gingiva, another band is placed on the tooth, superimposed on the first. These bands gently detach the gingiva from the tooth and tend to loosen the tooth. Intravenous injection of 400 mg. of the antihemophilic globulin fraction, or transfusion of 200 cc. of whole blood within the hour preceding the extraction provides the blood clotting factors needed in the patient's circulation. Local anesthesia of a periodontal infiltrative type is preferred because it obviates the likelihood of the trauma which may occur during the excitement stage when a general anesthetic is used.

Extraction is always slow and careful. Suturing is avoided when possible and only one tooth is removed at a time. The socket is filled immediately with thrombin powder.

Oxidized cellulose is inserted into the deepest third of the socket, and the opening at the top is gently and loosely filled. No pressure is used. Thrombin powder is placed on the splint in the area of the socket, and the splint is inserted. Here as elsewhere in the operation, pressure is avoided.

A second intravenous injection of the antihemophilic globulin fraction or transfusion of whole blood is given as a precaution the follow-

(2) White, P. H., and Mallett, S. P.: Management of hemophilia in dental extractions. J. Oral Surg. 7: 237-246, July 1949.

ing day. Subsequent extractions may be carried out in 2 weeks. The same splint may be extended to include the new extraction site and reused. Plastic teeth may be added to the splint for cosmetic reasons and as an aid to morale.

The operative aspect of dental hemorrhage would not be complete without some mention of internal hemorrhage which may occur as petechias, ecchymoses, or hematomas. Petechias are usually an indication of hemorrhagic disease. Ecchymoses and hematomas usually occur postoperatively. Their absorption may be facilitated by the application of alternating hot and cold packs. Occasionally a hematoma may develop following the injection of the local anesthetic, especially if a vessel wall is punctured. The danger of such an occurrence can be reduced by careful, slow needle penetration, by using a small gage needle, and by keeping the tip of the needle against bone during the entire injection procedure. Should a hematoma develop, the operator may apply cold compresses under strong pressure over the area involved, and thus keep the swelling to a minimum and aid natural drainage, or he may make an incision and aspirate the contents. The method to be used will depend on the operator, the location of the hematoma, the equipment available, and the condition of the patient. In any case, the patient should be informed of his condition, warned of the probable course of the hematoma, and instructed in home care. Only in this way can his fears and anxieties be relieved.

The postoperative treatment of dental hemorrhage starts before the patient leaves the office. At such a time the patient is usually nervous and his mind is preoccupied with thoughts of getting out of the room where the operation occurred. Therefore, it is a good idea to hand him a written list of postoperative suggestions. He will still have it for reference when your oral instructions are forgotten. Such a list should include: (1) biting pressure over sterile gauze for 30 minutes; (2) avoidance of the use of coffee, tea, and alcohol; (3) curtailing smoking for several hours because the nicotinic acid and heat interfere with normal healing; (4) avoidance of vigorous exercise; (5) keeping the tongue out of the socket; (6) avoidance of sucking on the wound; (7) avoidance of expectoration; (8) placing an ice bag on the appropriate side of the face for 20 minutes of each hour for the first 3 or 4 hours; (9) avoidance of rinsing the mouth for 24 hours; (10) taking a relatively soft diet for 24 hours; and, (11) if necessary, taking the capsules provided for pain. If the patient follows these simple rules faithfully, the incidence of postoperative hemorrhage can be appreciably reduced.

Should the patient have postoperative hemorrhage of the intermediate or secondary type, the first thing to do is to clean the mouth of any residual clot or other debris, and explore the socket for loose bone fragments, pieces of tooth, or other foreign bodies. A roentgenogram may be helpful. Once the source of the hemorrhage is determined, the

procedure is much the same as that outlined for controlling primary hemorrhage. If biting pressure over sterile gauze is not sufficient, digital pressure may be. If this is not successful, one of the chemical agents, such as tannic acid or epinephrine, may be added to the gauze. Should the hemorrhage still continue, an absorbable sponge material soaked with one of the thromboplastic agents should be used. As a last resort, a transfusion of whole blood may be ordered, but this is rarely necessary. An important adjunct to the treatment of postoperative hemorrhage is a calm, confident, reassuring manner. The patient is convinced he is bleeding to death, and if your demeanor does not allay those fears, he may do so.

## SUMMARY

Hemorrhage is an important consideration not only to the oral surgeon and the exodontist, but also to the periodontist, the endodontist, and, in fact, to every practitioner who uses a needle or any sharp cutting instrument in the mouth. Hemorrhage is a perfectly normal physiologic reaction without which normal healing could not take place. Occasionally, excessive blood loss requiring emergency measures for its control may occur. The dentist should not, however, fear hemorrhage to the point where necessary dental operations are postponed. With improved methods of anticipating excessive hemorrhage, with more efficient preoperative measures, with better developed surgical procedures, with a host of hemostatic drugs, thromboplastics, and absorbable sponge materials, and with direct transfusion of whole blood as a final safeguard, the dentist is now able to perform useful and necessary oral procedures even on known hemophiliacs.

# Medical Aspects of the Management of Mass Casualties[1]

H. Leonard Jones, Jr., *Commander, MC, U.S.N.*

A "SHOCK and Burn Program" was organized aboard the *U.S.S. Repose* prior to my assignment to that hospital ship in July 1947. It provided for a team of 3 medical officers (chief of medicine, medical officer in charge of medical and isolation wards, and a neuropsychiatrist), 2 nurses, and 10 hospital corpsmen trained especially for the treatment of shock and burns in the admission ward. Most of the details had been well worked out and specifically set forth in a memorandum from the senior medical officer. The principles of treatment were based to a large extent on experience gained in World War II (2-6).

## MANAGEMENT OF CHINESE CASUALTIES FOLLOWING AN EXPLOSION

In March 1948, while the ship was docked at Tsingtao, China, we had an opportunity to see how this program would work in actual practice for it was then that an explosion occurred in a Chinese ammunition dump about a mile from the ship. There were an estimated 200 casualties, all of whom were Chinese. Of these, 54 of the most serious were immediately

(1) Presented 29 November 1950 at semimonthly medical meeting, U. S. Naval Air Station, San Diego, Calif.

(2) National Research Council, Committee on Surgery: Burns, Shock, Wound Healing and Vascular Injuries. Prepared under the auspices of the Committee of the Division of Medical Sciences of Council. (Military surgical manuals, No. 5.) W. B. Saunders Co., Philadelphia, Pa., 1943.

(3) Reed, W. P., and Sweetser, H. B., Jr.: Symposium on military medicine aboard U.S.S. Samaritian; medical problems of internist on hospital ship. U. S. Nav. M. Bull. 46: 43-48, Jan. 1946.

(4) Drake, E. H.; Strange, W. W.; Sprague, H. B.; and McGinty, A. P.: Wartime log of the United States naval hospital ship Solace from June 1943. U. S. Nav. M. Bull. 48: 750-768, Sept.-Oct. 1948.

(5) Terrill, M.: Nursing on hospital ships. Mil. Surgeon 100: 418-421, May 1947.

(6) Roddis, L. H.: Wellcome prize essay; burns incident to war. Measures for their prevention and for treatment. Mil. Surgeon 94: 65-75, Feb. 1944.

brought by our ambulances to the ship. Practically all of them were in varying degrees of shock or incipient shock. Most of them, therefore, were first admitted to the shock and burn ward, which had 44 bunks. The majority of these casualties had multiple wounds and many had fractures; but only was one badly burned. Ten patients had craniocerebral injuries and 5 had fractured spines; all these required frequent neurologic evaluation. The complications observed were 1 case each of hemothorax (from fractured ribs), pneumonia, atelectasis, and pulmonary edema (cerebral). One blast injury of the abdomen was seen. One patient had no injuries but had developed a conversion hysteria in the form of a stocking anesthesia of both feet and legs. All patients except 4 who died, were transferred to local Chinese hospitals within a few days for further treatment.

## EXPANSION OF FUNCTIONS OF THE SHOCK AND BURN TEAM

In reviewing our experiences with these patients it was believed that the functions of the shock and burn team should be broadened to include most, if not all, possible medical aspects of casualties encountered either in peacetime or in wartime. The primary reason for this was to relieve the surgeons of everything possible except surgical operations. In this decision we were mindful of the excellent suggestions of McCombs (7), who described a plan used in a special treatment ward for critically injured patients in a naval base hospital and who summarized its advantages in these words: " * * * the saving of valuable time in emergencies, the more effective utilization of professional skills, the conservation of manpower among trained personnel, the improvement of patient's morale, the proper coordination of diverse therapeutic methods, and the early recognition and treatment of complications."

Accordingly, we expanded the special training of personnel and the supplies and equipment concentrated in this ward to anticipate the medical management not only of shock and burns, but also of asphyxia from aspiration, submersion, and smoke inhalation, blast concussion, chest injuries and their medical complications, as well as craniocerebral and spinal injuries. Moreover, the decontamination center for gas and atomic radiation casualties was located adjacent to this ward. Furthermore, the prevention and treatment of all medically controllable infections incident to trauma was the responsibility of this team, as well as the administration of analgesics, sedatives, stimulants, and the medical control of increased intracranial pressure, restoration and maintenance of fluid, nutritional and electrolyte balance pre- and post-operatively, even after the patient was sent to a surgical ward.

Because the paper work involved in keeping an adequate record of the rapidly changing condition of many patients was one of the most time-consuming operations, a special chart was devised to minimize it. This chart is a modification of that found to be useful by an Army shock

(7) McCombs, R. P.: Special treatment ward for critically injured. U. S. Nav. M. Bull. 45: 717-721, Oct. 1945.

team (8). The first sheet of the chart (fig. 1) is largely self-explanatory. With mass casualties, especially those in coma or those who are unable to speak English, it is helpful to assign consecutive numbers to patients

Date: . . . . . .

Name: . . . . . No. (X-ray No. Same)

Rate: . . . . . Service No. . . . . (USN) (USMC) (USA) (CIV)

Time of Injury: . . . Time of Admission: . . . . Blood Group: . . . . . .

Diagnosis . . . . . .

Cause of Injury: . . . . . .

. . . . . .

Description of Wound: (Use Attached Anatomical Chart) . . . . . .

. . . . . .

Neurological Data: (Use Attached Anatomical Chart) . . . . . .

. . . . . .

. . . . . .

. . . . . .

Extent of Burns: (Use Attached Anatomical Chart) . . . . . .

. . . . . .

X-ray Data: . . . . . .

. . . . . .

. . . . . .

. . . . . .

Surgical Data: . . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Time and Date of Transfer to Ward. . . . . : . . . . . .

(Critical List) (Serious List) Time: . . . . . Date: . . . . . .

(Deceased) Time: . . . . . Date: . . . . . .

Next of Kin: . . . . . .

Address: . . . . . .

NOTE.—Anatomical Charts have been attached to this chart for the purpose of indicating extent of burns, wound, fractures, and neurological signs. These charts will be used as far as is practicable.

*Figure 1.—First sheet (reduced from larger size).*

who can have corresponding numbers on their roentgenograms. The second sheet (fig. 2), to be attached to the first sheet, requires a minimal amount of writing for a complete 24-hour record of the patient's changing

(8) Birchall, R.: Management of shock ward. Mil. Surgeon 99: 181-190, Sept. 1946.

| | |
|---|---|
| | Time |
| | Blood pressure |
| | Pulse |
| | Respiration |
| | Temperature |
| | Pallor |
| | Perspiration |
| | Restlessness |
| | Dyspnea |
| | Vomiting |
| | Hemoptysis |
| | Hematuria |
| | Specific gravity (blood) |
| | Specific gravity (plasma) |
| | Other laboratory results |
| | Urinary output |
| | Whole blood |
| | Plasma |
| | Dextrose 5% in saline solution |
| | Dextrose 5% in distilled water |
| | Normal saline solution |
| | Liquids (orally) |
| | Morphine |
| | Amobarbital sodium |
| | Tetanus antitoxin |
| | Gas gangrene antitoxin |
| | Penicillin |
| | Coramine or stimulant |
| | Data or remarks |

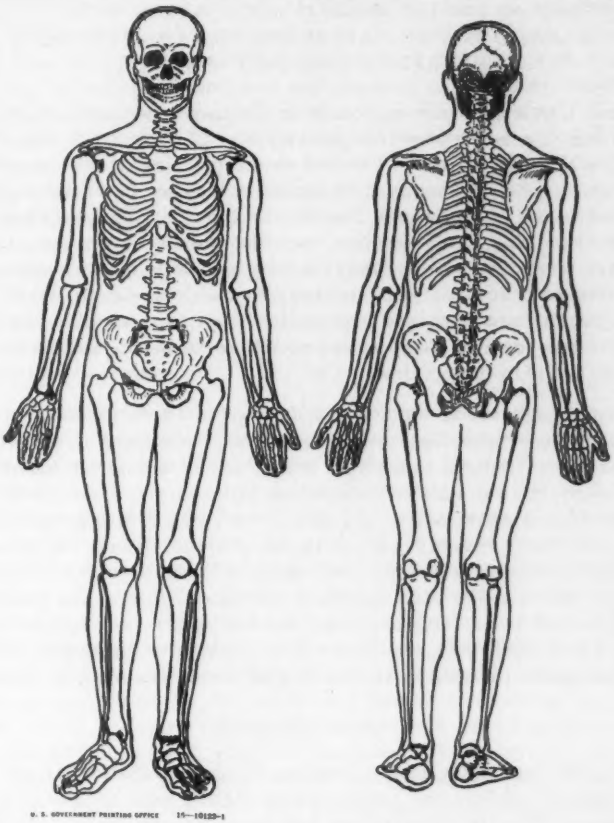
Treatment

*Figure 2.—Second sheet.*
*(Reduced from larger size to fit on this page—Editor.)*

NMSH—Form 59a
(1950)

ANATOMICAL CHART FOR CLINICAL RECORD

Name ..... Rank or rate .....



U. S. GOVERNMENT PRINTING OFFICE 16—10129-1

*Figure 3.*

vital signs, the treatment ordered, and treatment given. The medical officer simply indicates at the top of the second sheet how frequently the vital signs are to be taken, and the amount of a given fluid or other medication to be given; and the nurse or hospital corpsman writes in the time this is actually done, and makes other appropriate entries. Fluid intake and output can also be easily calculated at any given time, and changes in laboratory data can be readily correlated with clinical changes. It was also believed that much time could be saved by using one or more of the Navy's "Anatomical Charts for Clinical Record" (NMSH-Form 59a) (fig. 3) for each patient by indicating the essential data for

the location and extent of wounds, fractures, and burns, and neurologic signs, e. g., reflex and sensory changes, et cetera without the necessity of describing anatomic locations.

## MANAGEMENT OF CASUALTIES FROM BRITISH SHIPS SHELLED BY CHINESE COMMUNISTS

About 1 year after the explosion in Tsingtao, we had an opportunity to put our augmented plan into practice. On 21 April 1949, this ship received emergency orders to proceed to the junction of the Wangpoo and Yangtze rivers, near Shanghai, to assist in the care of British casualties incurred in the shelling of 4 British warships by Chinese Communists. These casualties, 78 in number, were in serious or critical condition, but they were received in stages over a period of 3 days and in some instances had received and responded to shock treatment. Even so, we found that the new plan, and especially the time-saving clinical and anatomic charts admirably met a need which we so keenly felt in the explosion at Tsingtao the previous year.

Even though shock was not as common in these patients, a number required close attention to maintain fluid, electrolyte, and acid-base balances and frequent neurologic evaluation. For example, there were 3 comatose patients with craniocerebral injuries, 3 patients with partial or complete transections of the spinal cord, and 2 with peripheral nerve injuries. Three patients with penetrating chest wounds complicated by hemopneumothorax presented particularly difficult problems. Only 3 were burned. Nine patients had compound fractures. Most of the patients had multiple soft tissue fragmentation wounds, many complicated by infection. There were 2 deaths in the 8 to 10 days of treatment, before the patients were transferred to the British Naval Hospital in Hong Kong.

## DISCUSSION

Of great importance in the handling of mass casualties is the prompt selection of critical and serious cases for the most rapid and efficient treatment. This is achieved by integrated activity among the various departments of the hospital unit through proper planning in advance. The component parts of a smoothly running therapeutic machine include: (1) proper selection through training and frequent drills of the team personnel in specifically assigned primary and alternate tasks, (2) centralization of essential supplies and equipment in admission and overflow wards, but adequate dispersal elsewhere, especially in wartime, and (3) the use of individual compact charts in order to reduce to a minimum the time required in recording essential clinical data, treatment prescribed and treatment given, and to have this information available for rapid inspection. Planning and teamwork epitomize these factors, which lead logically to efficiency and a high esprit de corps during the inevitably fatiguing management of large numbers of casualties in a critical condition.

It was a relatively simple matter to train selected hospital corpsmen and nurses for their assigned duties, which could be interchanged, for the most part, as the occasion demanded. Removing patients' clothes, taking and recording vital signs, notations of changing symptoms and signs, and reporting adverse changes to the medical officer, were generally done by 3 or more hospital corpsmen. Laboratory work was performed by laboratory technicians not assigned to the team, but the results were recorded by a designated corpsman on the team. Three or more hospital corpsmen generally gave the intravenous and oral fluids and other medications. The 2 nurses were usually busy with special nursing, dressings, oxygen administration, preparing for special treatments to be given by the medical officers, and informing them of sudden adverse changes in the condition of patients. The 3 medical officers were occupied with local and general physical or neurologic examinations reviewing the shock charts, writing orders, giving special treatments, and conferring with the surgeons on the priority of urgent operations. The latter was done in the operating room, on joint ward rounds, or in the x-ray viewing room.

Inasmuch as the 3 medical officers assigned to the shock team had little training, experience, and interest in major surgery, it was reasonable to assume that their services would best be used in the various duties required exclusive of such operative procedures. At first sight, such duties in handling traumatic casualties would appear to be chiefly in the domain of the surgeon, but many of these should in fact be of just as much interest to those primarily trained in general medicine, neurology, and psychiatry. Certainly this is true of the management of all phases of shock, fluid and electrolyte imbalances, most early burns, blast concussion, submersion, smoke narcosis, nonsurgical injuries of the nervous system, medical complications of thoracic injuries, infections and malnutrition incident to trauma (but preventable or controllable by purely medical measures), thromboembolic phenomena, and psychosomatic disorders caused or precipitated by trauma or threat of trauma. Much of the preoperative and postoperative care of patients sustaining injuries of any sort entails one or more of the above medical aspects.

Probably even more important would be the medical aspects in the management of mass casualties in atomic warfare. It has been estimated that between 20 and 30 percent of the fatalities at Nagasaki and Hiroshima were the result of flash burns (9). This does not include secondary burns from flaming wreckage. About 15 percent of the deaths at Hiroshima could have been caused by ionizing radiation effects, but most of these could just as well have been caused entirely by the con-

(9) Bureau of Medicine and Surgery, Navy Department: An Introduction to Radiological Safety: Medical Aspects of an Atomic Explosion; Thermal Blast. Government Printing Office, Washington, D. C., 1947. p. 41.

comitant blast trauma and burns (*10*). The low reported incidence of fractures and flame burns among these casualties has been ascribed to the failure of rescue operations. Though I have been unable to find estimates on the incidences of *nonfatal* cases of acute total body radiation illness and of flash burns, with or without associated blast injuries, I surmise from the nature of an atomic explosion that they would constitute a very high percentage, in combination at least. The treatment of radiation illness with its varying degrees of failure of erythropoiesis, agranulocytic infections, bacterial invasion, hemorrhage, vomiting and diarrhea from ulcerative gastroenteritis, as well as anaphylactoid phenomena is primarily medical and not surgical (*11*).

The modern treatment of flash or flame burns, in many instances in the earlier stages at least, is predominantly medical and often entails similar problems in fluid and electrolyte replacement and antibiotic therapy. The recent announcement (*12*) of the availability of ACTH and cortisone in Korea for field trial in the treatment of burns is encouraging. This is another illustration of the growing recognition of the importance of treating the patient "as a whole" in his reactions to injury and stress (*13*).

## SUMMARY

It is hoped that our experience will point up the need for extensive preparations for the management of far larger numbers of casualties in the event of disaster of any type at shore establishments and for the management of the patient as a whole and the creation of functional teams in the practice of this concept (*14*). Certainly planning and intensive training of personnel in specific primary and alternate duties will be advantageous in the event of mass casualties. Assignment of medical officers not only to surgical teams but also to medical teams, according to their aptitude, training, and experience is an important part of these preparations. The improved methods for early detection of peripheral circulatory failure, of hypoxia of any type, of fluid, electrolyte, nutritional, and endocrine imbalances, and the recognition of their potentially grave effects on the kidneys, brain, liver, and heart should be of equal concern to either team, regardless of the original cause. Their correction by refined technics, should be capably handled by a well-trained medical team while the surgical team is busy

(*10*) Aston, M. J.: Atomic bomb versus survival. Mil Surgeon *106*: 270-275, Apr. 1950.

(*11*) Cronkite, E. P., and Chapman, W. H.: Critical analysis of syndrome of acute total body radiation illness, role in atomic warfare and influence on future practice of military medicine. Mil. Surgeon *104*: 7-21, Jan. 1949.

(*12*) Association Notes: Cortisone and ACTH for Army Service. Mil. Surgeon *107*: 411, Nov. 1950.

(*13*) Selye, H.: General adaptation syndrome and diseases of adaptation. J. Clin. Endocrinol. 6: 117-230, Feb. 1946.

(*14*) Casberg, M. A.: Current trends in medical education. U. S. Armed Forces M. J. *1*: 1065-1076, Sept. 1950.

operating (15-21). Such division of responsibility and labor will surely be indicated in the management of the even more complicated casualties expected in the event of atomic warfare.

(15) Maddock, W. G.: Some fundamentals in water and electrolyte balance. Ohio State M. J. 45: 462-475, May 1949.

(16) Wagensteen, O. H.: Care of patient before and after operation; with special reference to fluid requirements and importance of weighing scale in evaluating status of hydration. New England J. Med. 236: 121-129, Jan. 23, 1947.

(17) Ravdin, I. S.: Recent advances affecting care of military casualties. Mil. Surgeon 106: 177-181, Mar. 1950.

(18) Merrill, J. P.; Levine, H. D.: Somerville, W.; and Smith, S., III.: Clinical recognition and treatment of acute potassium intoxication. Ann. Int. Med. 33: 797-830, Oct. 1950.

(19) Gamble, J. L.: Chemical Anatomy, Physiology and Pathology of Extracellular Fluid. 5th edition. Harvard University Press, Cambridge, Mass., 1947.

(20) Butler, A. M., and Talbot, N. B.: Medical progress; parenteral-fluid therapy; estimation and provision of daily maintenance requirements. New England J. Med. 231: 585-590, Oct. 26, 1944.

(21) Harrison, T. R.: Principles of Internal Medicine. The Blakiston Co., Philadelphia, Pa., 1950.

# Use of Excretory Urograms as a Screening Procedure

Thomas H. Williams, Jr., *Captain, U. S. A. F. R. (MC)* (1)

EXCRETORY urography is of special diagnostic use if one is fully aware of its limitations. This procedure has particular use in the smaller military medical establishments where x-ray facilities are available but a full-time urologist is not. For the past year we have used this idea in operating the urology clinic at this hospital. The clinic was scheduled to operate for 4 hours one morning every week and was conducted by a civilian urologist for the Air Force installations in this area. This amount of time was insufficient for evaluating a large number of new diagnostic problems and it soon became obvious that some sort of screening routine would have to be established. It was decided to have intravenous urograms and urinalyses on patients with complaints referable to the urinary tract but those with complaints referable to the genitals were not given a preliminary work-up because a large number of such patients could be seen in a relatively short time. By means of the urograms it was usually easy to determine whether or not further procedures were necessary and whether hospitalization were indicated.

The patients included military personnel, dependents, and civilian employees of Maxwell Air Force Base. Their ages ranged from a few months to 70 years. The diagnoses included carcinoma of the bladder, nephroptosis, chronic pyelonephritis, urinary tract calculi, hydronephrosis, renal ectopia, stricture of the ureter, pregnancy, and vesicorectal fistula.

The technic of urography consisted of restriction of food and fluids for 12 hours prior to roentgenography, a laxative the evening prior to roentgenography, and an intravenous injection of diodrast. This satisfactorily prepared the majority of these outpatients. For small children diodrast and hyaluronidase were given subcutaneously. Roentgenograms were taken at 5-minute intervals for 15 minutes, and after 30 minutes a roentgenogram was taken with the patient in the upright and the supine position. The latter was centered over the bladder and was especially

(1) Urologic consultant of the Station Hospital, Maxwell Air Force Base, Ala.

valuable in obtaining an excretory cystogram. The films were interpreted by both the radiologist and the urologist. Frequently films rated as unsatisfactory by the radiologist were considered adequate by the urologist. The radiologist reported what he saw in the films whereas the urologist used the urograms to give him clues and not necessarily diagnoses. With the clinical history in mind this was quite satisfactory. It was demonstrated again and again that a negative urine and negative physical examination did not exclude urinary tract diseases that could be diagnosed with excretory urograms. It was also evident that excretory urograms leave much to be desired in difficult diagnostic problems and are not a substitute for cystoscopy and retrograde pyelography. If this is borne in mind one is usually not lulled into a false sense of security by the use of this procedure.

During the 12-month period 432 outpatients were examined in the urology clinic. Of this group 102 had signs or symptoms indicating need for an excretory urogram. This procedure was usually carried out by the medical officers prior to referring the patients to the urologist. Of the 102 patients x-rayed 49 had positive findings (table 1). Although these findings often made further procedures necessary, negative findings did not exclude need of further procedures.

TABLE 1.—*Excretory urogram findings in 49 patients*

| *Diagnosis* | *Number of patients* |
|---|---|
| Nephroptosis | 11 |
| Neoplasm of ureter | 1 |
| Hydronephrosis | 10 |
| Vesicorectal fistula | 1 |
| Renal calculi | 11 |
| Ureteral calculi | 8 |
| Bladder calculi | 3 |
| Crossed ectopia | 1 |
| Polycystic disease | 1 |
| Carcinoma of the prostate | 1 |
| Pregnancy | 1 |
| Total | 49 |

Many of these patients had complaints that ordinarily would lead to physical examination, urinalysis, and then a prescription for either treatment of infection or control of pain. Too often this routine occurs when one physician has to see a large number of people in a supposedly healthy age group. If one follows the procedure we have used with this group of 432 patients it will not be long before it becomes obvious that many serious urologic diseases produce relatively few signs or symptoms. The following case histories illustrate this point.

## CASE REPORTS

*Case 1.*—A 30-year-old sergeant reported to the clinic complaining of bloody urine of 2 days' duration and pain in the right flank of 2 hours' duration. Two years previously he had noted a dull pain in the left lum-

bar area and had reported on sick call off and on for this complaint. His urine was grossly bloody and there was definite tenderness over the right kidney. The urograms revealed a large staghorn calculus in the left kidney, a small calculus in the right kidney, and another small calculus in the right ureter at the level of the fourth lumbar vertebra.

*Case 2.*—A 26-year-old airman came to the clinic complaining that he had "prostatitis." For the previous 6 months he had noted occasional burning on urination and frequency of urination. He had dull pain in the perineum from time to time. He had had occasional massages for "prostatitis." Examination was negative. Excretory urograms revealed normal kidneys and ureters but a suggestion of a filling defect on the right side of the bladder. Cystoscopic examination and biopsy at a later date revealed that this patient had transitional cell carcinoma of the bladder.

*Case 3.*—A 19-year-old married woman came to the clinic complaining of vague dull aching pain in the right flank. She had had this for 5 years but following a recent pregnancy noted marked increase in the severity of her pain. This pain did not radiate and was not colicky. She had no other urinary signs or symptoms. Her urine showed occasional pus cells. Urograms revealed that she had a hydronephrosis and nephroptosis of the right kidney.

## CONCLUSIONS

Excretory urograms are a valuable diagnostic aid in screening patients for possible urologic disease, especially in smaller military medical establishments. Excretory urograms are not a substitute for cystoscopy and retrograde pyelograms but can often obviate the need for this procedure thus avoiding discomfort to patient, loss of man-hours to the Armed Forces, and more efficient use of military hospital facilities and personnel. No matter how minor the urologic complaint, careful investigation is necessary.

# Prevention of Rheumatic Fever[1]

A REPORT of a study of the prevention of rheumatic fever by treating the preceding streptococcal infection is submitted at this time because the results obtained thus far appear to be sufficiently definite and favorable to warrant specific recommendations.

## DESCRIPTION OF THE STUDY

The study was conducted between 24 January 1949 and 22 February 1950. This air base houses a technical training school where about 60 percent of the men are trainees who report after 12 weeks of basic training at a southwestern base. All patients admitted to the hospital for respiratory disease were seen within a few hours by one of the members of the professional staff of the laboratory. Those having exudate on the tonsils or on the pharyngeal wall were included in the study group. A total of 2,340 such patients were observed. A total of 1,178 patients whose Air Force serial number ended in an even digit received penicillin treatment; 1,162 with an odd digit comprised the control group and received no specific treatment. Procaine penicillin G (suspended in peanut oil containing 2 percent aluminum monostearate) was given intramuscularly as soon after admission as possible, according to the treatment schedules outlined in table 1.

Follow-up studies for the detection of rheumatic fever were performed between the third and fourth weeks after the initial infection and without knowledge of the serial numbers of the patients or of their previous treatment. Those patients suspected of having acute rheumatic fever were hospitalized until a satisfactory diagnosis was established Routine electrocardiograms and sedimentation rates were obtained through the cooperation of the hospiral laboratory. Rigid criteria for diagnosis were followed, using a modification of the classification of

(1) From the Streptococcal Diseases Laboratory, Francis E. Warren Air Force Base, Wyoming, the Commission on Acute Respiratory Diseases (John H. Dingle, director), Armed Forces Epidemiological Board, and the Department of Preventive Medicine, School of Medicine, Western Reserve University, Cleveland, Ohio. The professional staff of the laboratory during the period of this study consisted of: Charles H. Rammelkamp, M. D., Field Director; Floyd W. Denny, Major, MC, A. U. S., Assistant Director; William R. Brink, Capt., MC, A. U. S.; Harold B. Houser, Capt., MC, A. U. S.; Edward O. Hahn, Capt., MC, A. U. S.; and Lewis W. Wannamaker, Capt., MC, A. U. S.

Jones. Major criteria included carditis, migrating polyarthritis, history of recurrences, chorea and subcutaneous nodules; minor manifestations included fever, arthralgia, skin rash, nonspecific electrocardiographic changes, and elevated sedimentation rate. For a diagnosis of definite acute rheumatic fever a patient had to present two major or one major and two minor manifestations. For a diagnosis of probable acute rheumatic fever a patient had to present one major and one minor, one major, or two minor manifestations. Instances of abdominal pain, epistaxis, pulmonary changes, and anemia were encountered, but did not contribute to the classification of these patients. No patient with chorea or subcutaneous nodules was encountered. Only those developing acute rheumatic fever within 45 days of onset of the observed streptococcal infection are included in this report

TABLE 1.—*Distribution of patients with exudative pharyngitis and tonsillitis according to treatment*

| Penicillin (1) dosage schedule | | Inclusive dates | Number | | Total |
|---|---|---|---|---|---|
| | | | Treated | Untreated | |
| I. | 300,000 U. stat.<br>300,000 U. 48 hr.<br>600,000 U. 96 hr. | 3 Mar.-15 Sept. 1949 | 634 | 582 | 1,216 |
| II. | 300,000 U. stat.<br>300,000 U. 72 hr. | 24 Jan.-2 Mar. 1949 | 254 | 288 | 542 |
| III. | 600,000 U. stat. | 16 Sept. 1949-22 Feb. 1950 | 290 | 292 | 582 |
| | Total | | 1,178 | 1,162 | 2,340 |

(1) Procaine penicillin G in peanut oil containing 2 percent aluminum monostearate.

Throat cultures and blood specimens were obtained from the patients on admission and again at the time of the follow-up examination. Strains of beta-hemolytic streptococci isolated from cultures were grouped and typed according to the method of Lancefield. Antistreptolysin "O" titers were performed on serums from acutely ill and convalescent patients according to a modification of the method of Hodge and Swift.

## RESULTS

Of the 1,178 patients who were treated with penicillin, only 2 developed definite acute rheumatic fever. In contrast, 28 of the 1,162 untreated patients developed the disease (table 2), a difference which is unlikely to be caused by chance. The diagnosis of possible acute rheumatic fever was made in 3 patients in the treated group and in 7 patients in the untreated group. Of the 2 patients in the treated group who became ill with rheumatic fever, one was treated within 9 hours after the onset of the symptoms of the streptococcic disease and the other about 4 days after onset.

TABLE 2.—*Poststreptococcal sequelas developing within 45 days after an attack of exudative tonsillitis or pharyngitis*

| Treatment schedule | Classification | Number of patients | |
|---|---|---|---|
| | | Treated | Untreated |
| I | Number of patients | 634 | 582 |
| | Definite rheumatic fever | 2 | 20 |
| | Possible rheumatic fever | 1 | 2 |
| II | Number of patients | 254 | 288 |
| | Definite rheumatic fever | 0 | 4 |
| | Possible rheumatic fever | 1 | 4 |
| III | Number of patients | 290 | 292 |
| | Definite rheumatic fever | 0 | 4 |
| | Possible rheumatic fever | 1 | 1 |
| Total | Number of patients | 1,178 | 1,162 |
| | Definite rheumatic fever | 2 | 28 |
| | Possible rheumatic fever | 3 | 7 |

The effect of penicillin treatment on the presence of beta-hemolytic streptococci in cultures of the throat is shown in table 3. In spite of the variation in the carrier rates during the course of the study, it is apparent from the data that penicillin therapy effected a reduction of Group A streptococci when compared to the control groups. Furthermore, there was a definite relationship between the effectiveness of such treatment and the dosage schedule of penicillin. The carrier rates were decreased 75, 60, and 46 percent by the penicillin dosage Schedules I, II, and III, respectively.

TABLE 3.—*Effect of 3 different schedules of penicillin on Group A streptococci*

| | Time of cultures | |
|---|---|---|
| | Group A on admission | Group A on follow-up examination |
| *Penicillin schedule I* | | |
| Treated: | | |
| Number cultured | 626 | 508 |
| Percent positive | 78.4 | 12.8 |
| Untreated: | | |
| Number cultured | 571 | 482 |
| Percent positive | 85.6 | 51.9 |
| *Penicillin schedule II* | | |
| Treated: | | |
| Number cultured | 251 | 200 |
| Percent positive | 66.5 | 17.5 |
| Untreated: | | |
| Number cultured | 287 | 234 |
| Percent positive | 66.9 | 44.0 |
| *Penicillin schedule III* | | |
| Treated: | | |
| Number cultured | 290 | 257 |
| Percent positive | 70.7 | 30.7 |
| Untreated: | | |
| Number cultured | 292 | 269 |
| Percent positive | 71.6 | 56.5 |

Because the number of true streptococcal infections varied somewhat during the study, the degree of inhibition of antibody by penicillin is best expressed as the percent reduction in the antibody increase in the treated as compared to the untreated patients. The degree of antibody inhibition produced by penicillin therapy in Schedule I was 51 percent, in Schedule II, 38 percent, and in Schedule III, 26 percent. It is thus apparent from these figures that, insofar as the suppression of antibody is concerned, the use of three injections totaling 1,200,000 units of depot penicillin was twice as effective as a single injection of 600,000 units.

The prevention of rheumatic fever, the inhibition of antibody, and the partial eradication of streptococci in the group of patients treated with penicillin assume more significance when the compositions of the treated group and of the control group are compared. That the two groups were comparable is demonstrated in table 4. Moreover, a large proportion of the illnesses in both groups was streptococcal in origin;

TABLE 4.—*Comparability of the treated and untreated groups*

| | Treatment schedule | | | | | |
|---|---|---|---|---|---|---|
| | I | | II | | III | |
| | Treated (percent) | Untreated (percent) | Treated (percent) | Untreated (percent) | Treated (percent) | Untreated (percent) |
| Age 17 - 20 years | 82.9 | 80.9 | 87.2 | 90.2 | 72.8 | 72.9 |
| Previous history of: | | | | | | |
| Rheumatic fever | 2.2 | 2.6 | 2.4 | 2.8 | 1.4 | 1.7 |
| Heart murmur | 1.7 | 1.4 | 2.0 | 2.4 | 4.5 | 5.8 |
| Tonsillectomy | 25.7 | 30.6 | 28.0 | 28.8 | 23.8 | 22.9 |
| Confluent exudate | 7.7 | 6.0 | 7.1 | 4.5 | 9.3 | 8.6 |
| Leukocyte count of 12,000 or over on admission | 65.2 | 71.5 | 60.9 | 58.9 | 60.8 | 56.6 |
| Group A streptococci throat culture on admission | 78.4 | 85.6 | 66.5 | 66.9 | 70.7 | 71.6 |
| Type distribution of group A streptococci: | | | | | | |
| Type 5 | 26.3 | 28.4 | 24.0 | 20.8 | 12.2 | 15.3 |
| Type 14 | 40.9 | 33.1 | 15.6 | 19.8 | 53.2 | 48.3 |
| Type 24 | 16.7 | 19.8 | 49.1 | 43.8 | 8.8 | 7.2 |
| Antistreptolysin titer of 125 or less on admission | 68.4 | 70.1 | 76.3 | 67.4 | 66.0 | 70.7 |
| Treated less than 24 hours after onset of respiratory symptoms | 27.8 | | 26.0 | | 24.0 | |
| Follow-up obtained | 81.4 | 83.7 | 78.7 | 83.0 | 90.3 | 92.5 |

Group A beta-hemolytic streptococci were isolated from 76 percent of all admission cultures and 68 percent of the untreated patients showed a two-tube or greater antistreptolysin response.

## DISCUSSION

The data presented concerning the incidence of rheumatic fever in the treated and control groups establish the fact that penicillin therapy for acute streptococcal infections will almost completely prevent the

subsequent occurrence of rheumatic fever. These results emphasize again the close relationship between streptococcal disease and rheumatic fever.

Sulfonamides have proved to be ineffective in the prevention of rheumatic fever when used in treating the acute streptococcal illness. Previous experience with penicillin has been conflicting. Weinstein et al. *(2)* treated 225 patients with scarlet fever with penicillin; 7 of these subsequently developed rheumatic fever. This observation supports Finland's *(3)* conclusion from a review of the literature that penicillin is not effective when used in this manner for the prevention of rheumatic fever. On the contrary, Massell et al. *(4)* employed penicillin to treat 10 clinical and 5 subclinical hemolytic streptococcal infections in patients hospitalized for rheumatic fever or rheumatic heart disease; these patients failed to exhibit subsequent recurrences. Jersild *(5)* has shown that poststreptococcal complications, including nephritis, are reduced after penicillin treatment of the initial illness, but makes no statement of the occurrence of rheumatic fever.

Exudate on the tonsils or oropharynx was used as the sole means of selection of patients to be included in this study because it was a rapid, easily standardized method. It was thought that such a criterion would include the majority of streptococcal respiratory infections because various studies have shown that exudative lesions of the throat appear in from 60 to 90 percent of streptococcal infections, particularly in a population experiencing epidemic rates of streptococcal illnesses. The isolation of Group A streptococci from 76 percent of the patients and the demonstration of an increase in the antistreptolysin "O" titer in 68 percent of the control group indicate that the majority of the patients actually had streptococcal disease. A few undoubtedly had nonstreptococcal exudative tonsillitis.

If the incidence of rheumatic fever is to be reduced materially by early treatment with penicillin, it becomes necessary that streptococcal infections be diagnosed accurately and early. In some patients the clinical findings alone will permit an almost certain diagnosis of a streptococcal infection. Characteristically, such illnesses present a sudden onset of sore throat with pain on swallowing, fever and other constitutional reactions, diffuse redness and edema of the soft palate, tonsils and oropharynx, discrete or confluent exudate, and large or tender cervical lymph nodes. Supportive data may be obtained from the laboratory. Many patients will have an elevated leukocyte count. Cultures of the pharynx will almost always show a predominant growth of

*(2)* Weinstein, L.; Bachrach, L.; and Perrin, T. S.: Studies of influence of penicillin on immune reactions in streptococcal pharyngitis. J. Clin. Investigation *28*: 817-818, 1949.

*(3)* Finland, M.: Use of penicillin in infections other than bacterial endocarditis. Advances Int. Med. *2*: 350-438, 1947.

*(4)* Massell, B. F.; Dow, J. W.; and Jones, T. D.: Orally administered penicillin in patients with rheumatic fever. J.A.M.A. *138*: 1030-1036, Dec. 4, 1948.

*(5)* Jersild, T.: Penicillin therapy of scarlet fever and complicating otitis. Lancet *254*: 671-673, May 1, 1948.

beta-hemolytic streptococci. Depending on the availability and use of the above criteria, a large percent of streptococcal respiratory infections can be reliably and rapidly diagnosed, particularly during an epidemic period. Treatment with penicillin can thus be instituted immediately.

## SUMMARY

Evidence is presented to indicate that rheumatic fever can be prevented by the treatment of streptococcal disease with penicillin. A total of 1,178 patients with streptococcal infections were treated with penicillin; only 2 subsequently developed acute rheumatic fever. Of 1,162 untreated patients, 28 developed the disease. Penicillin therapy likewise suppresses the antistreptolysin "O" response and eradicates the streptococci in many cases.

## RECOMMENDATIONS

All patients with streptococcal infections should receive penicillin.

1. Selection of patients for treatment with penicillin:

a. All patients reporting to the dispensary or to the hospital presenting classical features of streptococcal respiratory disease should receive penicillin therapy. Streptococcal infections develop rapidly and are usually associated with sore throat (pain on swallowing), fever, diffuse redness and edema of the soft palate, tonsils and oropharynx, discrete or confluent exudate, and large and tender cervical lymph nodes. Classically, such patients develop a leukocytosis and show streptococci on culture.

b. In areas where streptococcal infections are epidemic, all patients with exudative tonsillitis or pharyngitis should be considered streptococcal in origin and receive treatment.

c. In military installations where nonstreptococcal exudative tonsillitis or pharyngitis is common, a leukocyte count should be obtained from each patient exhibiting exudative lesions. When this count is 10,000 or greater, treatment should be instituted.

d. All personnel admitted to the hospital with respiratory infections not characterized by exudative tonsillitis or pharyngitis should have a leukocyte count. If this count is 10,000 or greater the disease should be considered streptococcal in origin. Exclusion of other diagnostic categories by clinical or laboratory data should be made.

e. In those hospitals where adequate bacteriologic facilities are available, a throat culture should be obtained from each patient admitted to the hospital with respiratory disease. Those patients whose cultures show 10 or more colonies of beta-hemolytic streptococci on sheep blood agar plates should receive penicillin therapy.

2. Methods of treatment:

a. For patients who do not give a past history of rheumatic fever or who have no evidence of rheumatic heart disease, one of the following treatment schedules should be employed: (1) Six hundred thousand units of crystalline procaine penicillin G (suspended in peanut oil containing 2 percent aluminum monostearate) on admission and again 72 to 96 hours after the first dose. (2) Three hundred thousand units of depot penicillin on admission, 300,000 units at 48 hours, and 600,000 units at 96 hours.

b. Patients with streptococcal infections who give a past history of rheumatic fever or who have evidence of rheumatic heart disease should be treated more intensively, as follows: Twenty-five thousand units of the sodium salt of penicillin every 3 hours for 8 to 10 days.

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# Protection of the Pulp

Stanley S. Cohen, *Captain, DC, U. S. A.* (1)

THE reactions of dental pulp to stimuli are different from those of any other tissue in the body. The pulp is less able to react in its own defense and generally initiates various degenerative processes as a result of mild injuries. This is because of its embryonic and undeveloped nature, its confinement in unyielding walls, and its copious blood vascular system and general environment. The functions of the pulp are to build and maintain the dentin and to transmit sensation. Various local irritants, which may be traumatic, chemical, thermal, or electric, may elicit responses in the pulp from which it is incapable of recovering. These irritations stimulate the pulp tissue through the dentinal tubules and the dentinal fibrils in the tubules. Whether the mechanism of pulp stimulation is through impulses transmitted along the fibrils to sensory nerve endings in the vicinity of the odontoblast cells, or by means of hydrostatic pressure exerted on the tubules and transmitted to the nerve endings, or whether the fibril itself is a sensory nerve ending is not definitely known (2) (3) (4) When these stimuli are mild, the resulting changes are protective.

The pulp may initiate two constructive changes, calcification of the dentinal tubules (sclerosed or transparent dentin) and the formation of secondary dentin. Calcification is preceded by a fatty degeneration of Tomes' fibrils (5), followed by a precipitation of inorganic salts in the tubules. Under magnification these areas appear transparent or translucent, in contrast to the opaque normal dentin. These tubules are impermeable to dyes, while normal tubules become completely impregnated. Sclerosed dentin is harder than normal dentin (6). It affords greater protection to the pulp from abrasion and the penetration of the

(1) Walter Reed Army Hospital, Washington, D. C.

(2) Hill, T. J.: Text-book of Oral Pathology. 4th edition. Lea & Febiger, Philadelphia, Pa., 1949.

(3) Kronfeld, R.: Histopathology of Teeth and Their Surrounding Structures. 2d edition. Lea & Febiger, Philadelphia, Pa., 1939.

(4) Stones, H. H.: Oral and Dental Diseases. Williams & Wilkins Co., Baltimore, Md., 1948.

(5) Bodecker, C. F.: Fundamentals of Dental Histology and Embryology. Columbia University Press, New York, N. Y., 1944.

(6) Hodge, H. C., and McKay, H.: The micro-hardness of teeth. J. Am. Dent. A. 20: 227, 1933. Quoted by Stones, H. H.: Oral and Dental Diseases. Williams & Wilkins Co., Baltimore, Md., 1948. p. 309.

acids which cause caries. It reduces irritation of the pulp because of the absence of tubules to transmit impulses. This reaction takes place under carious lesions, metallic fillings, areas of trauma, and erosion. It is the earliest and simplest form of constructive change that the pulp exhibits in response to the mildest type of irritation.

The formation of secondary dentin often accompanies the calcification of the tubules. Two types of secondary dentin are recognized, and the type formed depends on whether any odontoblasts survive. Irrespective of type, this secondary dentin is deposited over the pulpal end of the tubules and differs from the original dentin. The mechanism and chemistry of this process is unknown, but Stones *(4)* suggested that injury to the odontoblasts may be associated with a resultant liberation of phosphatase which accounts for the calcific deposition. Fish *(7)* has named these areas of secondary dentin "dead tracts" because they no longer receive any nutrition, and are impermeable to dyes. In ground sections with transmitted light they appear dark. If any odontoblasts survive, a modified tubular type of dentin is deposited. The tubules in this dentin are fewer in number and coarser than those of normal dentin and run irregularly. The calcification is usually deficient. The deposition may begin after the laying down of a hyaline barrier, or it may be a continuation of the primary dentin, depending on the extent of injury to the odontoblastic layer. This type of dentin is usually laminated in appearance indicating periodic deposition.

When all the odontoblasts in an area die as a result of a more severe irritation, a hyaline and/or cellular secondary dentin is laid down. This type does not contain tubules. It is often laminated, as is the tubular variety, and contains cells or not, depending on whether the cells have a chance to retreat before calcifications occurs. This depends on the speed of deposition.

In any event, the rate of deposition of the hyaline or cellular type of dentin is usually more rapid than that of the tubular type. This is logical in view of the fact that any secondary dentin deposition is a protective reaction on the part of the pulp, and the greater the need, or the more severe the irritation, the faster the pulp reacts. Gottlieb *(8)* has a different explanation for secondary dentin formation. He believes that (1) the odontoblasts form fibrils rather than dentin; (2) the surrounding connective tissue forms the dentin, and it is excited to activity by stimulation through the fibrils; (3) when the odontoblast layer is intact, the activity of the connective tissue and hence the formation of secondary dentin are slowed down; and (4) when the odontoblasts in any area are destroyed, the connective tissue comes into contact with the dentin and an area of increased secondary dentin formation results.

*(7)* Fish, E. W.: An experimental investigation of the enamel, etc., London, 1932. Quoted by Rushton, M. A.: Observations on Fish's "dead tracts" in dentine. Brit. Dent. J. 68: 11-13, Jan. 1, 1940.

*(8)* Gottlieb, B.: Formation of secondary dentin and related problems. J. Dent. Research 25: 29-34, Feb. 1946.

Bodecker *(5)* stated that the speed with which secondary dentin is deposited and the mechanism involved is not clear. What is known is that it is produced in response to irritation and it increases the distance between the pulp and the irritant, and thus protects the pulp. The reason why secondary dentin activity varies in different persons and in different teeth in the same person is obscure. Irritants of long standing, that are not sufficiently severe to cause degenerative changes, seem to favor secondary dentin formation.

The dentist is called on to restore teeth and to maintain their vitality. These teeth vary in the severity of their destruction and include the sound tooth, perhaps prepared for a bridge abutment; the carious tooth; the deep carious tooth or near exposure; the so-called "pin point exposure"; and the exposure, either pathologic or caused by a fractured crown. The primary task is to induce the pulp to initiate these constructive changes without which little restorative dentistry could succeed. The pulp cavity is divided anatomically into the pulp chamber, found within the coronal portion of the tooth, and the pulp canal, found within the root *(9)*. The outline of the pulp chamber varies roughly with the crown form and is continuous with the pulp canals. There is usually one pulp canal for each root, although sometimes a root contains more than one pulp canal.

The pulp cavity tapers from the crown to the apex, its size varying with the age of the tooth, its function, and history *(9)*. Thus the ratio of crown to coronal pulp continually decreases throughout life because of the protective mechanism inherent in the healthy pulp. The first part of the coronal pulp to be obliterated by normal wear would be the prolongations of the pulp chamber called pulp horns. These correspond to the lobes of the tooth or the centers of calcification *(9)*. When these horns are obliterated by the deposition of secondary dentin, the original outline of the pulp chamber can usually be seen because of the difference in color and translucency between the secondary and primary dentin. It is possible and often desirable to stimulate the pulp mechanically, and so cause a similar deposition of secondary dentin which brings about a withdrawal or shrinkage of the pulp, while maintaining its vitality. This is best, and most safely accomplished by judicious cavity preparation and insertion of sedative dressings such as zinc oxide and eugenol. Gutta percha or temporary stopping is useless for this purpose. It does not stimulate the pulp to deposit dentin, and because it does not seal the cavity, it allows it to become contaminated. Too much heat is required in placing the material, and it is certainly not easily worked and handled.

This subject of cavity sterilization is highly controversial. The stand one takes seems to depend, to a large degree, on one's beliefs regarding dental decay. Miller, in his chemicoparasitic theory, believed that

*(9)* Wheeler, R. C.: Textbook of Dental Anatomy and Physiology. W. B. Saunders Co., Philadelphia, Pa., pp. 271-272.

decalcification of the dentin preceded bacterial invasion. Thus removing all soft or involved dentin sufficed for the preparation of the cavity. Zander *(10)* believed that bacterial invasion of tubules preceded decalcification. He thus concluded that removal of all the involved dentin is not sufficient to remove all the bacteria and showed that cavities prepared in the usual manner are not sterile, and cultures made 6 to 12 months after preparation yielded living organisms. Seltzer *(11)* corroborated Zander's work and suggested that the chances of mechanically removing all bacteria is slightly better than 50 percent. The bacterial involvement of prepared cavities was shown to vary directly with the depth of the original lesion.

This evidence would seem conclusive and yet there is dissension. Many dentists make no attempt at cavity sterilization and their clinical experience has been that there was no recurrence of decay under the filling. Experiments led Klein and Knutson *(12)* to conclude that the carious process stops when the oral environment is sealed off, even in the presence of bacteria. It has been shown that the deposition of secondary dentin effectively blocks off any possible extension of the bacteria in the direction of the pulp. The lactobacillus dies off quickly when left under a filling, but various strains of staphylococcus and streptococcus will persist for more than a year *(12)*.

Bacteriologic studies lead us to accept the majority opinion that cavity sterilization is necessary, or at least desirable. Thus, we come to the question: Can it be attained? Seltzer *(13)* *(14)* examined various agents (table 1) and determined Morson's creosote to be the best. His results with physiologic saline, used as a control, were better than with some of the more popular medicaments. He decried the use of 95 percent alcohol, claiming that it produced pulp irritation and pain through its desiccant effect on the cavity walls.

Pure thymol crystals have a slight anesthetic effect as well as an antiseptic effect, and so are of value in reducing dentinal pain *(11)*. Thymol penetration is often insufficient to reach the micro-organisms responsible for the dental decay. It is highly recommended for its anesthetic effect following mechanical irritation incident to cavity preparation.

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*(10)* Zander, H. A.: Bacteria in the dentin after cavity preparation. Illinois Dent. J. 207, June 1940.

*(11)* Seltzer, S.: Bacteriologic status of dentin after cavity preparation. J. Am. Dent. A. *27*: 1799-1801, Nov. 1940.

*(12)* Klein, H., and Knutson, J. W.: Studies on dental caries; effect of ammoniacal silver nitrate on caries in the first permanent molar. J. Am. Dent. A. *29*: 1420-1426, Aug. 1, 1942.

*(13)* Seltzer, S.: Comparative value of various medicaments in cavity sterilization. J. Am. Dent. A. *28*: 1844-1852, Nov. 1941.

*(14)* Seltzer, S.: Effectiveness of antibacterial agents used in cavity sterilization. J. Dent. Research *21*: 269-277, June 1942.

Markley *(15)* stated that he was dubious about the possibility of true cavity sterilization but was concerned with the contamination incident to cavity preparation. He recommended first working under a rubber dam. He pointed out the absolute necessity when using a sterilizing agent of recutting the cavity walls to remove the fine layer of medicament and so assure a good seal between tooth and filling material. Experimentation has shown that micro-organisms penetrate into dental tubules from 0.08 to 1.2 mm. beyond the hard surface of the underlying caries *(11)*. Howe's ammoniacal silver nitrate, which is generally credited with being the most penetrating sterilizing agent, penetrates an average of 0.6 mm. under the best conditions *(16)*. This falls far short of the progress of the bacteria in the tubules.

TABLE 1.—*Comparative effectiveness of medicaments tested in the sterilization of dentin (1)*

| *Medicament* | *Effectiveness (percent sterilization)* |
|---|---|
| Morson's creosote | 86 |
| 10 percent aqueous solution of iodine | 78 |
| Pure liquid phenol | 69 |
| Physiologic saline solution | 47 |
| Isotonic iodine solution | 44 |
| 50 percent thymol in alcohol | 39 |
| 50 percent phenol in alcohol | 29 |
| Howe's silver nitrate | 28 |
| 95 percent alcohol | 28 |

*(1)* Taken from reference footnote 13.

Silver nitrate is admittedly bactericidal if it comes in contact with bacteria. Thus, the surface of the dentin is sterilized and through the precipitation of the protein silver complex the dentin tubules are effectively blocked, and any residual bacteria are trapped on the one side by silver salt precipitation and the other by secondary dentin *(13)* *(17)*.

Seltzer *(13)* and Klein and Knutson *(12)* believed that silver nitrate was a poor agent for cavity sterilization. They grant that it is bactericidal but claim it is too self-limiting because of its coagulation. Coolidge *(18)* and Ireland *(16)* credited silver nitrate with an irritating action on the pulp that causes the deposition of secondary dentin, and thus with effectively checking the extension of the dental decay. It was also found

*(15)* Markley, M.: Statements from Lecture Delivered at the District of Columbia Postgraduate Clinic, 14 March 1950.

*(16)* Ireland, R. L.: Ammoniacal silver nitrate as sterilizing agent for deep-seated decay in deciduous teeth. J. Am. Dent. A. *26*: 871-878, June 1939.

*(17)* McGehee, W. H. D., and Green, M. W.: Pharmacology and Pharmacotherapeutics for Dentists. The Blakiston Co., Philadelphia, Pa. 1948.

*(18)* Coolidge, E.: Treatment of deep dental caries. Illinois Dent. J. *1*: 363, May 1942.

*(16) (19)* that the penetration of silver nitrate is deeper in nonvital than in vital teeth and that although it is a pulp irritant when used in close proximity to the pulp, contrary to former belief, it does not of its own accord devitalize either deciduous or permanent teeth. Thus it may also be used in near exposures to induce secondary dentin formation.

Muntz, Dorfman, and Stephan *(20)* obtained some diametrically opposed, yet interesting results. They found that the superficial layers of carious dentin were almost always infected, that intermediate layers were sometimes infected, and that partially decalcified dentin and sound dentin were almost always sterile. Working on the premise that it is often desirable and necessary in deep cavities to leave a small amount of carious or at least decalcified dentin in the floor of the cavity to avoid exposure of the pulp, they set up various experiments to determine whether it is possible to sterilize dentin without pulpal injury. They agreed with Miller that water-soluble substances such as iodine trichloride, mercury bichloride, and hydrogen peroxide were best for dentin sterilization, and that phenol was a poor penetrating agent. They further stated that oil of peppermint and oil of clove are worthless. They found saturated silver nitrate to be the best agent for dentin sterilization. Of 16 agents tested, it was the only one that sterilized carious dentin from 0.8 to 1.5 mm. thick. They further found that the depth of penetration of an agent is greater than its depth of sterilization.

They concluded that saturated silver nitrate was the best agent available in that it would sterilize carious dentin to an average depth of 0.3 mm. by a 1-minute application and to 1.3 mm. in 10 minutes. They found ammoniacal silver nitrate to be slightly less effective, 30 percent hydrogen peroxide much less effective, and 20 percent zephiran chloride and 95 percent phenol almost useless. They further confirmed Howe's observation that silver nitrate penetrates sound dentin only slightly and concluded that a small amount of secondary dentin would prevent any silver nitrate from reaching the pulp tissue.

Treating exposed teeth has long been tried with little success, the usual eventual treatment being root canal therapy or extraction. The long series of disappointing results obtained with dozens of pulp capping materials has led most men to disregard this form of treatment. Glass and Zander *(21)* using calcium hydroxide, demonstrated healing under the capping. Pulp capping is carried out to maintain the vitality of the tooth, but is justifiable only if healing results under the capping material. Previous work by Zander and others has proved that the pulp is capable of healing. In studying pulp amputations, definite histologic

*(19)* Seltzer, S., and Werther, L.: Conservative silver nitrate treatment of borderline cases of deep dental caries. J. Am. Dent. A. *28*: 1586-1594, Oct. 1941.

*(20)* Muntz, J. A.; Dorfman, A.; and Stephan, R. M.: In vitro studies on sterilization of carious dentin; evaluation of germicides. J. Am. Dent. A. *30*: 1893-1900, Dec. 1943.

*(21)* Glass, R. L., and Zander, H. A.: Pulp healing. J. Dent. Research *28*: 97-107, Apr. 1949.

evidence of dentin forming along the line of amputation was demonstrated.

Glass and Zander *(21)* set up a controlled experiment to study the results of pulp capping clinically and histologically. They used sound young pulps in teeth to be extracted for orthodontic reasons. Using both calcium hydroxide with tap water, and zinc oxide with eugenol alternately, the teeth were exposed and capped; and then extracted and studied after from 24 hours to 12 weeks after placing the capping. They found that pulp capped with calcium hydroxide remained free from inflammation and healed within 4 weeks, but those capped with zinc oxide and eugenol showed no healing. Furthermore although the zinc oxide and eugenol cappings remained vital and showed no clinical symptoms during 12 weeks, a chronic inflammatory reaction persisted at the site of exposure.

Seltzer *(14)* suggested that preliminary experiments with zinc oxide and creosote as a pulp capping agent warranted further investigation.

## SUMMARY

There has as yet been little progress in protection of the pulp. We have learned much about the pathology and histology of the pulp in recent years. We have also increased our mechanical skill, have devised new and better preparations and restorations, and have discovered means to minimize thermal and mechanical shock to the pulp. Unfortunately, too little basic bacteriologic and chemical work has been done. Research and investigation in this field are made difficult by the tremendous task of controlled experimentation in vivo. Although the various medicaments now used do not completely sterilize cavities, some operators do have success with one or another of them. This success seems to depend largely on the removal of all the carious material. In doing this we remove most, if not all, of the bacteria and so give the tissue a better chance to combat the process. Whether the tissue is able to react in its own defense depends on its ability to form secondary dentin. Age, systemic health, diet, heredity, and many other factors determine this. Undoubtedly the best way to enlist the aid of the constructive pulp changes, to be reasonably sure of removing all carious dentin and all bacteria, and to obviate the need for pulp capping, is to open and fill all cavities as soon as detected.

# Hemorrhagic Manifestations of Sickle Cell Disease

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Roger H. Fuller, *Commander, MC, U.S.N.* (1)

SICKLE cell disease is a morbid state caused by the presence in the erythrocytes of an inherited abnormal or defective hemoglobin which, when reduced, causes the cell to assume a typically crescentic shape. Persons having this abnormal hemoglobin in their red blood cells but not in sufficient concentration to allow significant sickling in vivo are said to have sickle cell trait. In the writings since Herrick's (2) original description of the disease, attention has been focused most sharply on the anemia which is one of the chief features of the disease. Bauer (3) and others have pointed out, however, that the disease may be present without anemia. In fact, the main threat to the health and life of the patient is not the anemia but the capillary stasis occasioned by intravascular sickling, conglutination, and thrombosis. Death may ensue as a result of the generalized capillary plugging before anemia is manifest.

Another feature of the disease that has not been emphasized as much as the anemia is the hemorrhagic tendency which is occasioned by the capillary plugging and thromboses. Indeed, hemorrhage may be the only manifestation of the disorder as is illustrated by case 1.

## CASE REPORTS

*Case 1.*—A 21-year-old Negro, previously well, without antecedent trauma, had been having painless hematuria for 2 months. He occasionally passed small clots in the urine. At times no blood was present in the urine. There was no frequency, nocturia, or dysuria. He was previously treated for 6 weeks in an Army hospital where hematuria and albuminuria were noted. The cystoscopic findings were normal except for blood coming from the right ureter. His nonprotein nitrogen and blood

(1) U. S. Naval Hospital, Great Lakes, Ill.

(2) Herrick, J. B.: Peculiar elongated and sickle-shaped red corpuscles in case of severe anemia. Arch. Int. Med. 6: 517-521, Nov. 1910.

(3) Bauer, J. (Los Angeles): Sickle cell disease; pathogenic, clinical and therapeutic considerations. Arch. Surg. 41: 1344-1362, Dec. 1940.

pressure were normal. Retrograde pyelography was normal. Later he was admitted to this hospital where the roentgenographic examination of his chest was normal. Several urine specimens were grossly bloody with specific gravity as high as 1.024 and albumin as high as 4 plus. The Kahn test was negative. The erythrocyte count was 5.03 million with 15 grams of hemoglobin. The leukocyte count was 5,750 with 60 percent neutrophils, 35 percent lymphocytes, 4 percent monocytes, and 1 percent eosinophils. The bleeding time was 2 minutes and 15 seconds, the coagulation time of venous blood was 10 minutes. The sedimentation rate was 6. Repeated cystoscopic examinations confirmed the bleeding from the right ureter. No acid-fast bacilli or tumor cells were found in the urine.

Because of his persistent hematuria and the impossibility of ruling out neoplasm and tuberculosis, a right nephrectomy was performed. The kidney weighed 190 grams, with a capsule that stripped easily from a smooth cortical surface which was extensively mottled with dark red and pale areas. The structures of the hilus appeared normal. On the cut surfaces there were large zones of opaque red discoloration underlying the red zones on the surface and extending through the cortex and medulla. Serial gross sections failed to reveal a neoplasm. In the mucosa of the pelvis and some of the calyces, as well as the upper portion of the ureter, were small hemorrhagic spots.

Microscopically, the normal kidney architecture was preserved. The glomeruli, particularly in the red areas, were large with engorged capillaries stuffed with closely packed distorted red blood cells. The afferent arterioles were greatly dilated and plugged by these conglutinated red blood cell masses (fig. 1). Erythrocytes were present in Bowman's space and in the lumina of the renal tubules. In many instances, Bowman's space was distended and contained an eosinophilic protein precipitate. The tubular capillaries were also greatly dilated and stuffed with closely packed sickled red blood cells. There was fresh hemorrhage in the subepithelial tissues of the pelvic mucosa beneath intact epithelium. From the microscopic study it appeared that the source of the bleeding was glomerular capillary stasis, with blood escaping from the glomerular capillaries into the renal tubules. No other cause of hematuria could be found. Following operation, the hematuria disappeared and the patient became completely asymptomatic. Examination of his blood for sickling revealed none in the direct smear. Less than 1 percent of his red blood cells sickled in a sealed chamber after 24 hours. In the microscopic sections of the tissues which had been fixed in formalin, however, practically all of the red blood cells had assumed the sickled shape.

*Comment.*—In 1948, Abel and Brown *(4)* reported the case of a 26-year-old Negro who underwent a nephrectomy with an erroneous diag-

*(4)* Abel, M. S., and Brown, C. R.: Sickle cell disease with severe hematuria simulating renal neoplasm. J. A. M. A. *136*: 624-625, Feb. 28, 1948.

nosis of renal neoplasm, without preoperative evidence to suggest sickle cell disease. The hematuria was ascribed by the pathologist to hemorrhage into the renal pelvis caused by sickled erythrocytes obstructing the vessels. In 1950, Goodwin et al. (5) reported seven cases of unilateral renal bleeding ascribed to sickle cell disease. It would seem

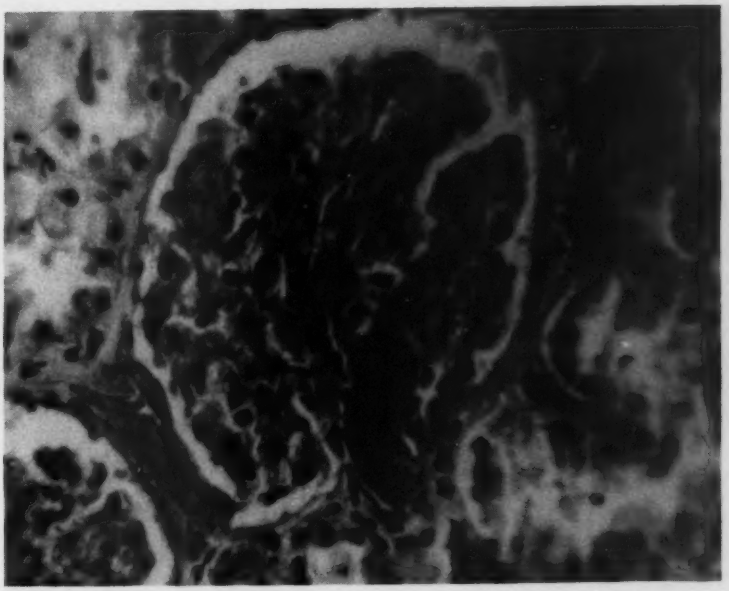

*Figure 1.—Case 1. Section of renal glomerulus showing capillary engorgement and plugging of the afferent arteriole by a conglutinated mass of erythrocytes.*

apparent, therefore, that one of the causes of so-called essential hematuria in Negro or Negroid patients is sickle cell disease. In our patient bleeding was apparently focal and small in amount. So far as could be determined, bleeding was not occurring from any organ other than the right kidney. It was speculated that some abnormality of the circulation of the right kidney may have allowed greater reduction of the hemoglobin and a greater degree of sickling at that site than elsewhere in the body. In a severe crisis of the disease, however, bleeding may be generalized, although more severe in one locality than in others. This is illustrated by the following two cases.

*Case 2.*—A left salpingo-oophorectomy was performed on a 24-year-old gravida 1 para O Negress early in the pregnancy because of an ectopic tubal pregnancy. She also had an intra-uterine pregnancy which,

(5) Goodwin, W. E.; Alston, E. F.; and Semans, J. H.: Hematuria and sickle cell disease; unexplained, gross unilateral, renal hematuria in Negroes, coincident with the blood sickling trait. J. Urol. 63: 79-96, Jan. 1950.

following operation, progressed satisfactorily under obstetrical supervision, except for epistaxis. About 1 week before admission she began to complain of epigastric pain, nausea, and vomiting, which became much more severe. On admission to this hospital in the seventh lunar month of her pregnancy, she complained of frontal headache, difficulty in breathing, and pain and tenderness in the right upper abdominal quadrant. Her blood pressure was 120/80. Her lungs were clear. The abdominal findings were consistent with a 7-month pregnancy with a viable fetus. A urine specimen, obtained by catheter, was grossly bloody and contained 4 plus albumin and no sugar. The nonprotein nitrogen was 27 mg. per 100 cc. The Kahn test was negative. After being in the hospital for about 6 hours, she became comatose. Her blood pressure rose to 242/150. Fundoscopic examination revealed retinal hemorrhages which rapidly increased in size. Lumbar puncture released grossly bloody spinal fluid under 550 mm. of aqueous pressure.

The erythrocyte count was 4.86 million with 13.5 grams of hemoglobin. The leukocyte count was 21,000 with 69 percent segmented cells, 4 percent band forms, 17 percent lymphocytes, 5 percent monocytes, and 5 percent eosinophils. The fetal heart tones disappeared and the patient died shortly thereafter with a diagnosis of spontaneous subarachnoid hemorrhage.

The autopsy revealed a large cerebral hematoma in the left frontal lobe which had ruptured into the subarachnoid space and into the left lateral ventricle. The ventricular system of the brain was filled with clotted and unclotted blood. There were multiple small hemorrhages into the somatic muscles, serous membranes, peritoneum, pleura, pericardium, epicardium, endocardium, myocardium, gastric and intestinal mucosa, and liver. The liver weighed 1,860 grams and was of normal shape. The external surfaces showed innumerable small red ecchymotic blotches beneath the capsule, particularly on the superior aspect. On the cut surfaces, large and small red hemorrhagic zones were scattered diffusely throughout, but more prominently in the right lobe. The gross appearance of the liver suggested the hemorrhagic necrosis of eclampsia. The uterus contained a normal female fetus, 35 cm. long, weighing 910 grams, attached by a normal umbilical cord to a small placenta implanted in the fundus. Beneath the area of implantation were two small leiomyomas in the myometrium, the larger 3 cm. in diameter. There were two small foci of retroplacental hemorrhage and early dissection of blood between the uterus and fetal membranes. The placenta contained many areas of fibrosis and necrosis scattered through the organ. These were much more numerous than would be expected in a placenta of this age. There were no abnormalities of the fetus. The spleen weighed 165 grams. The capsule was thin. There were no scars or infarcts. The cut surfaces were normal except that they appeared unusually congested. There was moderate pulmonary congestion and edema. The kidneys together weighed 305 grams and grossly appeared normal.

The diagnostic impression from the gross examination was eclamptic toxemia of pregnancy with cerebral hemorrhage. Microscopically, however, sections of the tissues, which had been fixed in formalin, revealed in all organs marked engorgement and dilatation of capillaries and sinusoids. These were stuffed with masses of closely packed sickled red blood cells and were associated with interstitial hemorrhage. In many of the vessels the red blood cells were hemolyzed and it was noted that the "ghosts" had lost their distorted sickled shape and had assumed a globular form. In the spleen there was marked vascular and sinusoidal

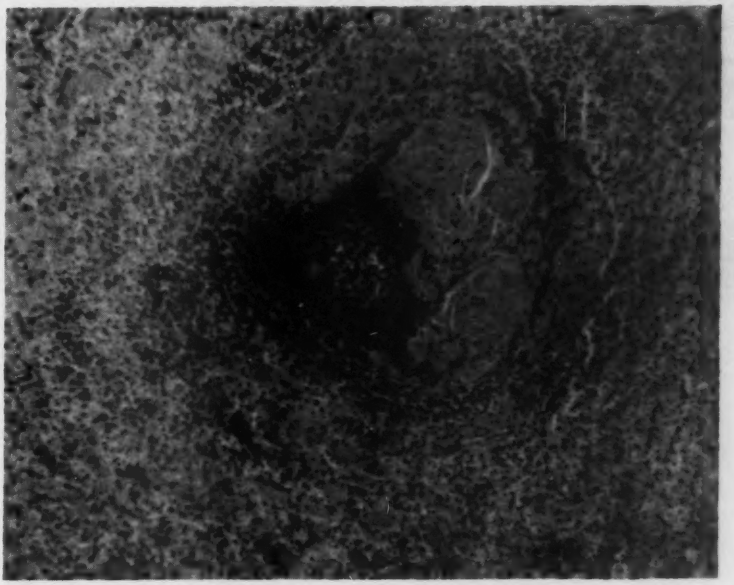

*Figure 2.—Case 2. Section of spleen showing perifollicular hemorrhage.*

dilatation and engorgement. The perifollicular hemorrhages described by Rich (6) were easily seen (fig. 2). The lymphoid follicles appeared to float in large pools of blood. There was also hemorrhage into the red pulp. In fact, the entire organ was flooded with sickled erythrocytes. Phagocytosis of these distorted cells was conspicuous. In the liver there was tremendous focal dilatation of the sinusoids in all zones of the lobule (fig. 3). In some of these greatly dilated sinusoids, sickled red blood cells were tightly packed. In others, the sinusoids contained the ghosts of hemolyzed erythrocytes. The hepatic cord cells were compressed, and frequently had disappeared in the region of these dilated sinusoids. In the intervening areas the liver cells appeared healthy.

(6) Rich, A. R.: Splenic lesion in sickle cell anemia. Bull. Johns Hopkins Hosp. 43: 398-399, Dec. 1928.

Sections of the placenta showed large areas of hyalinization and fibrosis with necrosis and intervillous fibrin deposits. There was definite necrosis of the decidual plate and hemorrhages consisting of maternal blood were seen. In the placenta almost all the maternal red blood cells were sickled although the fetal erythrocytes were not (fig. 4). The maternal cells did not stain as deeply as those of the fetus. Sections of the brain also showed dilatation and stasis of capillaries and small vessels caused by plugging with sickled red blood cells. There was some hemorrhage into the Virchow-Robin spaces. Blocks from the border of the large hematoma showed only fresh hemorrhage with no reaction to it. The vessels in the renal cortex were filled with red blood cells, most of which were hemolyzed. Apparently a shunting of blood had occurred into the medulla because the medullary vessels were engorged with tightly packed sickled red blood cells. There was definite granular degeneration of the tubular epithelial cells. The collecting tubules contained granular heme casts as well as red blood cells. Sections of the posterior portion of one of the eyes showed hemorrhage into the sheath of the optic nerve as well as into the retina. The pathologist's diagnosis was sickle cell disease in crisis, with a large cerebral hemorrhage.

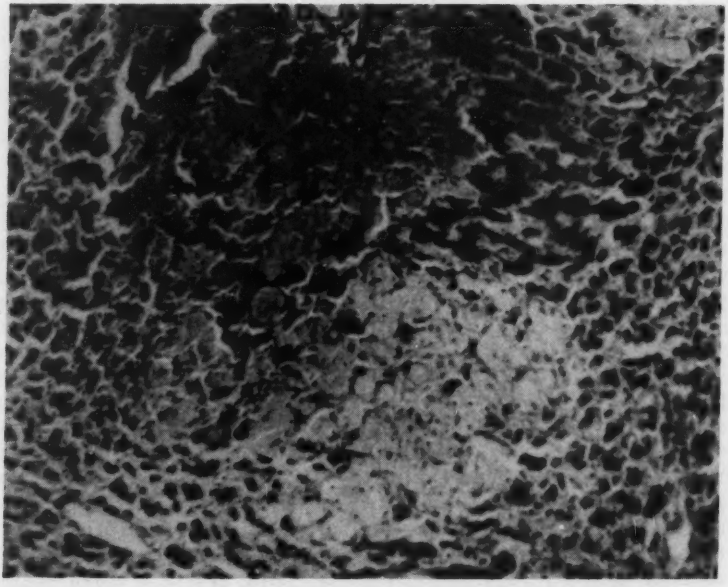

*Figure 3.—Case 2. Section of liver showing focal sinusoidal dilatation. Some sinusoids contain tightly packed sickled erythrocytes; others contain "ghosts" of hemolyzed erythrocytes.*

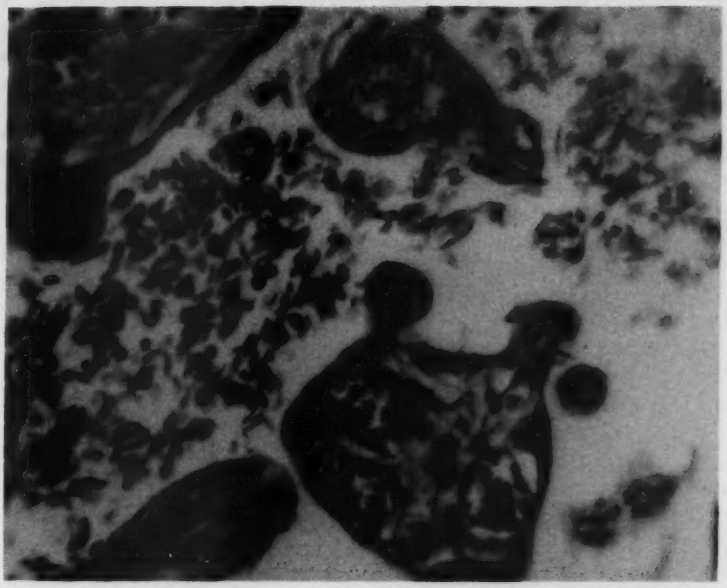

*Figure 4.—Case 2. Section of placenta showing sickling of maternal erythrocytes in sinusoids but not of fetal erythrocytes in vessels of chorionic villi.*

*Case 3.*—An 18-year-old Negro was admitted to this hospital with severe abdominal pain. Two days prior to admission he had diarrhea. On the morning of admission he had had a rapid onset of continuous abdominal pain radiating to the lumbar vertebral region and legs. Physical examination showed lower abdominal tenderness without spasm, and tenderness over the lumbar spine. The erythrocyte count was 3.9 million with 11 grams of hemoglobin. The leukocyte count was 14,300 with a normal differential cell count. One urine specimen was negative, but a subsequent specimen showed 1 plus albumin with no blood. Over a period of 2 days, the patient's temperature rose to 103.8° F. He became irrational, showed icterus of the scleras for the first time, and died shortly thereafter.

At autopsy there were petechial hemorrhages in the palpebral conjunctiva and in the serous membranes. There were hemorrhagic areas in the gastric and intestinal mucosa. The bowel contained blood at irregular intervals. The spleen was large, weighing 875 grams, and bound down over the lateral surface by dense fibrous adhesions. The splenic capsule was thickened. The organ was firm. The cut surfaces were dark red-brown and the normal markings were obscured. The liver weighed 1,900 grams, was fairly firm, and the cut surfaces were red-brown with obscured markings. The kidneys appeared normal. There were epicardial and subendocardial hemorrhages. The pleural surfaces of the lungs

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were densely speckled with small petechias. The cut surfaces of the lungs were pale and studded with dark red hemorrhagic blotches. The brain appeared normal. Microscopically there was generalized capillary dilatation and engorgement with sickled red blood cells. There was hemorrhage, especially in the spleen, bowel, and lung (fig. 5). The spleen showed several fibrous and siderotic scars as well as fresh perifollicular hemorrhage and tremendous engorgement of the sinusoids. Phagocytosis of red blood cells was prominent. Hemosiderin was abun-

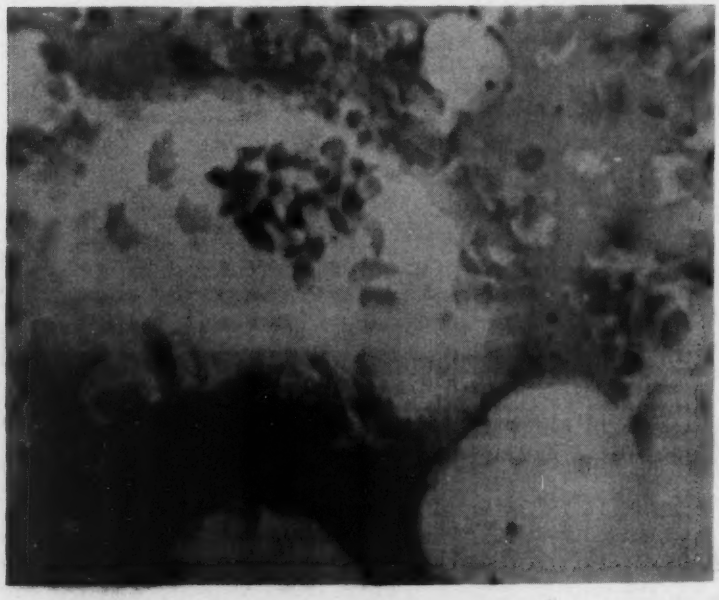

*Figure 5.—Case 3. Section of lung showing sickled red blood cells in one alveolus and edema fluid in an adjacent one.*

dant in the liver, spleen, and lymph nodes. The final diagnosis was sickle cell disease in crisis with pulmonary and gastrointestinal hemorrhage.

## DISCUSSION

The pathogenesis of the bleeding in this type of patient is readily understood from an examination of the microscopic sections. Although bleeding time and clotting time are normal, the hemorrhage appears to be caused by plugging of the small blood vessels by masses of sickled erythrocytes. The impaction of red blood cells is favored by their abnormal shape and particularly by the unusually long flagellas which many of these cells possess. These long whiplike processes are well

illustrated in the Rebuck et al. (7) report of their electron microscopic studies of sickled cells. Anoxia leading to sickling which favors impaction of the red blood cells in the capillaries and increased anoxia gives rise to a vicious circle of sickle cell crises. The trigger mechanism which initiated the anoxia is not well understood, but infection, toxemia, anesthesia, and mild shock have been implicated. In our Case 2, pregnancy, which has an unfavorable influence on this condition, may have been an initiating factor.

Sickle cell disease is one of the intrinsic causes of anemia due to increased blood destruction. It occurs almost exclusively in Negroes, although a few cases have been reported in mulattoes, Indians, and Mediterranean people. Wintrobe (8) reported the incidence of sickle cell trait as 7.3 percent in a series of 8,453 Negroes. Of those with this trait, 1 in 15 showed anemia. The trait is mendelian dominant constitutional abnormality of the erythrocytes which undergo sickling in the presence of decreased oxygen tension. Pauling (9) localized the abnormality in the hemoglobin molecule.

One of the most recent reports on the clinical manifestations is that of Grover (10) who reported on 48 cases of active sickle cell anemia during 10 years at Kings County Hospital, Brooklyn, N. Y. All had an onset of symptoms before reaching 20 years of age, and all were admitted before they were 35 years old. The sex incidence was equal, and 10 percent occurred in siblings. All had a temperature of 100 to 101° F. and a pulse rate of 90 to 100. The most prominent symptoms were joint pains (70 percent), abdominal pain (48 percent), chronic ulcers of the extremities (25 percent), neurologic changes (17 percent), and severe epistaxis (1 percent). The enlargement of the spleen and liver was marked and rapid.

Hodges and Bernstine (11) reviewed the 23 reported cases of pregnancy in sickle cell disease. Eighteen were under 30 years of age, 9 had a history of spontaneous abortion, 9 had hypertension, and 6 died. Of 19 infants borne by mothers with sickle cell disease, 14 showed positive sicklemia. Hodges and Bernstine stated that the combination of albuminuria, edema, hypertension, convulsions, and coma in pregnant women with sickle cell disease usually leads to the clinical diagnosis of eclampsia. Two of their patients suggested the presence of cerebral thromboses, hemorrhages, or both. Their conclusion was that in sickle

(7) Rebuck, J. W.; Woods, H. L.; and Monaghan, E. A.: Electron microscopy of sickle cells. Proc. Soc. Exper. Biol. & Med. 68: 220-222, May 1948.

(8) Wintrobe, M. M.: Clinical Hematology. 2d edition. Lea & Febiger, Philadelphia, Pa., 1946.

(9) Pauling, L.: Sickle cell anemia; a molecular disease. Science *110*: 543-548, Nov. 1949.

(10) Grover, V.: Clinical manifestations of sickle cell anemia. Ann. Int. Med. *26*: 843-851, June 1947.

(11) Hodges, J. H., and Bernstine, J. B.: Sickle cell anemia and pregnancy. Am. J. Obst. & Gynec. *54*: 108-113, July 1947.

cell disease with pregnancy, vascular phenomena, particularly thrombosis, occur frequently. These may relate to symptoms of toxemia of pregnancy.

Hughes et al. *(12)* stated that brain lesions in sickle cell disease with cerebral complications are varied but primarily intravascular and caused by thrombosis, following which there is extension of the thrombotic process with hemorrhagic degeneration and atrophic changes. The most common autopsy finding in the brain is dilatation of peripheral blood vessels and a congestion with sickled erythrocytes, most marked in the gray matter and in the vessels within the subarachnoid spaces over the cerebral hemispheres. Other vascular lesions include hemorrhage and necrosis.

Gradwohl and Kouri *(13)* described the laboratory findings as follows: an erythrocyte count of about 3 million; hemoglobin proportional to the erythrocyte count; color index normal; leukocyte count of from 10,000 to 30,000; differential leukocyte count showing a frequent regenerative shift with a definite increase in reticulocytes; and occasional nucleated erythrocytes and Howell-Jolly bodies. Sickling is unusual in the ordinary blood smear, although 75 to 100 percent of the erythrocytes may sickle in a moist anoxic preparation. The anemia is normocytic normochromic in type. Diggs and Pettit *(14)* wrote an excellent critique of the methods used in the detection of sicklemia. Their conclusion was that the most practical method is that of Scriver and Waugh, which entails the application of a rubber band to the patient's finger for 5 minutes, then pricking the finger and rapidly putting the drop of blood on an ordinary glass slide, covering and compressing the drop, then sealing with vaseline. Seven percent of 406 Negroes showed an average of 35 percent sickling by this method. Without the rubber band, only 2 percent of the same group showed an average of 1 percent sickling. The gas chamber method of Hahn and Gillespie and the moist dye method of Hansen-Pruss showed poorer results. The dye used, brilliant crystal blue, was definitely shown to inhibit sickling, which outweighed the advantage of its beauty. By all methods the preparation may be observed at convenient intervals during 24 hours at room temperature.

Daland and Castle *(15)* stated that sickling occurs when the oxygen tension is less than 45 mm. Hg., and that a decreased *p*H increases the sickling tendency. They therefore recommend 1 to 2 drops of 2 percent sodium metabisulfite plus 1 drop of blood, then they make a thin film with a coverslip, stating that sealing of this preparation is unnecessary.

*(12)* Hughes, J. G.; Diggs, L. W.; and Gillespie, C. E.: Involvement of nervous system in sickle-cell anemia. J. Pediat. *17:* 166-184, Aug. 1940.

*(13)* Gradwohl, R. B. H., and Kouri, P.: Clinical Laboratory Methods and Diagnosis, Vol. 1. 4th edition. C. V. Mosby Co., St. Louis, Mo., 1948. p. 729.

*(14)* Diggs, L. W., and Pettit, V. D.: Comparison of methods used in detection of sickle-cell trait. J. Lab. & Clin. Med. *25:* 1106-1111, July 1940.

*(15)* Daland, G. A., and Castle, W. B.: Simple and rapid method for demonstrating sickling of red blood cells; use of reducing agents. J. Lab. & Clin. Med. *33:* 1082-1088, Sept. 1948.

Sickling by this method also occurs in 15 minutes. It is more convenient than the hydrogen sulfide test because sodium metabisulfite tablets can be dissolved in water to make a quite stable solution.

Grover *(10)* emphasized the value of x-ray examination in the diagnosis, stating that 85 percent of his 48 cases of sickle cell anemia showed cranial and 57 percent showed long bone changes compatible with the disease. The radiologic changes are secondary to the overactive bone marrow. Sante *(16)* reported the skull, especially the parietal bones, to be thick, with active diploe producing spicules of new bone cut from the skull so that it appears on the film that the patient's hair is standing on end. He says that long bone changes are rare, though he describes a case of destruction of the lower portion of the humerus.

Beckman *(17)* stated that no satisfactory treatment was available. Davison *(18)* said that transfusions were of temporary benefit and might be dangerous; that liver, iron, copper, and oxygen therapy were without proved value; and that splenectomy was followed by improvement but that in 50 percent the anemia recurred after a few months though the results were better if the spleen was large than if it was small.

Davison *(18)* reported the prognosis as poor because between the acute attacks, which recur every 1 or 2 years, the patient is seldom able to perform heavy work. He survives a number of acute attacks, then dies of an infectious disease before reaching 30 years of age. Frazier and Rice *(19)* reported several deaths in infants showing as much as 50 percent sicklemia within their first year.

## CONCLUSIONS

In some patients hemorrhage may be the chief manifestation of sickle cell disease. Severe disease may be present without anemia. A high degree of suspicion of sickle cell disease is essential when a Negroid patient presents unexplained symptoms. Tests for sickle cell trait should be done on Negroes before induction into the military service.

*(16)* Sante, L.: Principles of Roentgenological Interpretation. 7th edition. Edwards Brothers, Inc., Ann Arbor, Mich., 1947.

*(17)* Beckman, H.: Treatment in General Practice. 6th edition. W. B. Saunders Co., Philadelphia, Pa., 1948.

*(18)* Davison, W. C.: The Compleat Pediatrician. 6th edition. Duke University Press, Durham, N. C., 1949.

*(19)* Frazier, C. A., and Rice, C. E.: Neonatal sickle cell anemia. J. A. M. A. *143*: 1065-1067, July 22, 1950.

# Lipoma of the Colon

## A Case Report

Max L. Smith, *Lieutenant Colonel, MC, U.S.A.* (1)
Leonard D. Heaton, *Major General, MC, U.S.A.* (1)

THERE were 172 cases of lipoma of the colon reported up to March 1949 (2) (3) (4) (5). Adenomatous polyps are the most common benign tumors of the colon, with lipomas ranking second (6) (7). Lipomas are important because they are most often seen in patients in the fifth and sixth decades and because they cannot be distinguished roentgenographically from malignant lesions of the bowel. Malignant change in these tumors has never been noted.

### CASE REPORT

A white 47-year-old master sergeant, admitted to this hospital on 4 November 1950, stated that in September 1949 he had had an episode of diarrhea and vomiting with mild fever, lasting about 10 days. At that time he noted large amounts of mucus with small flecks of blood in the stool. He was given "diarrhea mixture" and was well until June 1950, when a shorter, milder, similar episode occurred. Late in September he again had a 2- to 3-day episode of diarrhea with blood-flecked mucus. Following this, there was a sense of urgency to empty the bowel, but only small amounts of formed stool were passed. On 6 October he was first examined proctoscopically and two small polyps were seen at a depth of 12 and 20 cm., with small areas of ulceration near the polyps. On 13 October the two polyps were removed and were reported by the pathologist as being "rectal polyps, atypical." The ulcerated areas

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(1) Letterman Army Hospital, San Francisco, Calif.

(2) Comfort, M. W.: Submucous lipomata of gastro-intestinal tract; report of 28 cases. Surg., Gynec. & Obst. 52: 101-118, Jan. 1931.

(3) Gault, J. T., and Kaplan, P.: Submucous lipoma of colon; report of case. Am. J. Surg. 53: 145-151, July 1941.

(4) Pack, G. T., and Booher, R. J.: Intussuscepting submucous lipoma of right colon. S. Clin. North America 27: 361-372, Apr. 1947.

(5) Mayo, C. W., and Griess, D. F.: Submucous lipoma of colon. Surg., Gynec. & Obst. 88: 309-316, Mar. 1949.

(6) Pemberton, J. deJ., and McCormack, C. J.: Submucous lipomas of colon and rectum. Am. J. Surg. 37: 205-218, Aug. 1937.

(7) Helwig, E. B.: Benign tumors of large intestine—incidence and distribution. Surg., Gynec. & Obst. 76: 419-426, Apr. 1943.

were still present. Examination of the stool at that time showed only many red and white blood cells. On 16 October the patient was again examined protoscopically and the ulcerations were unchanged. Examination of the stool revealed *Trichomonas hominis* in large numbers, but no parasitic cysts. On 23 October a barium enema revealed a filling defect 2 cm. in diameter in the ascending colon. This was confirmed on 27 October by an air contrast enema (fig. 1). On 3 November the proctoscopic appearance of the bowel was normal.

*Figure 1.*

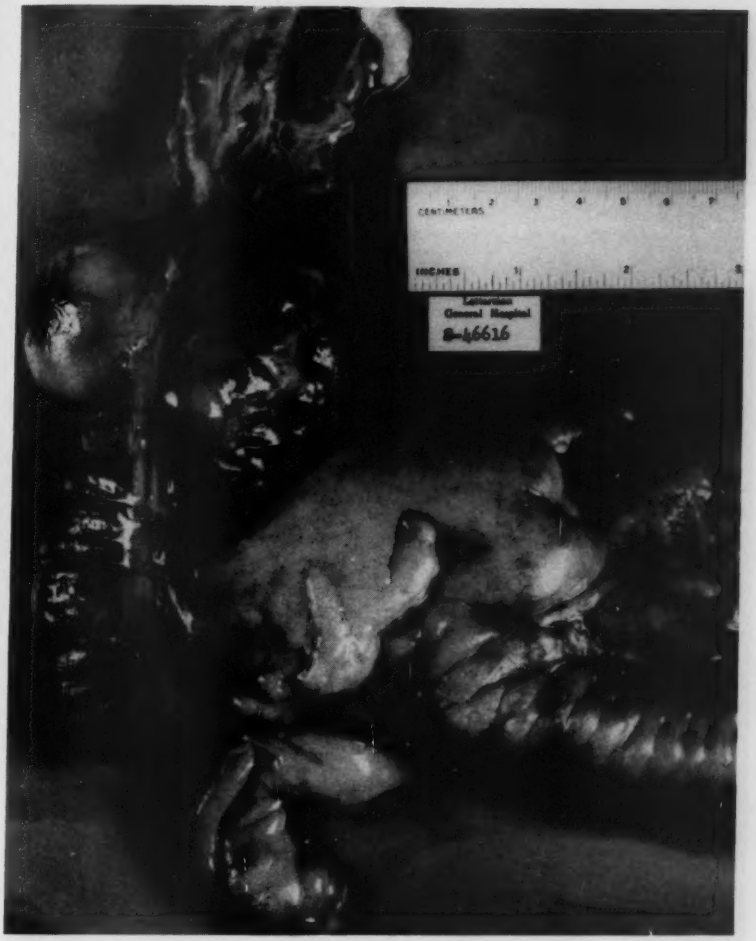


*Figure 2.*

The patient had had a known duodenal ulcer since 1940 and had had recurrent symptoms since that time. He had had a parathyroid adenoma removed in April 1949, which was reported by one of us (L.D.H.) *(8)*. He was prepared for intestinal operation by the oral administration of a mixture of 2 grams of streptomycin and 8 grams of glucuronolactone *(9)*

*(8)* Reiner, D. E., and Heaton, L. D.: Parathyroid adenoma; report of two cases. U. S. Armed Forces M. J. *1*: 403-408, Apr. 1950.

*(9)* Glucuronolactone has been found *(10)* to prolong the bacteriostatic action of streptomycin. The exact mechanism of this action is not known.

*Figure 3.*

daily in divided doses for 4 days *(10)*. On 10 November 1950 an exploratory laparotomy was performed through an upper right transverse abdominal incision. A red-yellow, rubbery, elongated, relatively smooth, encapsulated tumor measuring about 4 cm. in diameter by 7 cm. in length was found in the mid-ascending colon. The tumor was about half subserosal and half submucosal. The mesentery and liver were normal

*(10)* Pulaski, E. J.; Connell, J. F., Jr.; and Seeley, S. F.: Sterilization of intestinal tract by antibiotics and supplemental agents. Ann. Surg. *132*: 225-234, Aug. 1950.

to palpation and inspection. The tumor was judged to be a lipoma but, because malignancy could not be ruled out, a right colectomy was carried out. Bowel continuity was reestablished by an end-to-side ileotransverse colostomy. Convalescence was uneventful.

*Pathologic findings.*—The specimen consisted of the ascending colon with the cecum, the appendix, and a portion of the terminal ileum. A soft round protrusion of the serosa was noted, which projected into the lumen in a fingerlike polypoid fashion (figs. 2, 3, 4, and 5). The

*Figure 4.*

*Figure 5.*

entire mass measured 7 by 4 by 4 cm. On cut section the mass appeared to be made up of uniform yellow fat. The overlying mucosa was normal. Microscopically, the tumor was covered with normal large bowel mucosa. The lamina propria was infiltrated with lymphocytes, plasma cells and macrophages. The tumor itself was composed of a large mass of fat cells, uniform in size, shape, and staining reaction. There was no evidence of malignancy.

## DISCUSSION

Comfort *(2)* classified these tumors into three groups: (1) subserous, (2) submucous, and (3) a combination of subserous and submucous. Our case falls into the third group. Thirty-three, or 19.2 percent, of the reported cases were asymptomatic. We doubt that the symptoms which led our patient to seek medical aid were caused by his lipoma. They are better explained on the basis of the transient rectal ulceration. When symptomatic, the complaints usually point to either an obstructing or bleeding lesion. The intestine may be mechanically blocked by the size of the tumor, or, in the more pedunculated varieties *(4)* *(11)*, intussusception may occur. The bleeding is caused by erosion of the surface and is more often seen in left-sided lesions. Bleeding is reported in from 25 to 50 percent of the symptomatic cases *(5)* *(6)*. The absence

*(11)* Manheim, S. D., and Peskin, H.: Spontaneous elimination of lipoma from sigmoid flexure. J.A.M.A. *118*: 1214-1215, Apr. 4, 1942.

of severe anemia and the frequent long history of symptoms will suggest a benign lesion but does not obviate the necessity for exploration. The treatment is surgical excision and, because malignancy is not a hazard, the simplest procedure is the best. Although it has been possible, in an isolated instance, to enucleate one of these tumors without opening the mucosa *(12)*, because these tumors are often of large dimensions and because the presence or absence of malignancy is difficult to assess accurately, we believe that it is preferable to treat them by right colectomy or segmental resection, according to the anatomic sites involved.

*(12)* Mayo, C. W.: Lipoma of colon. Proc.Staff. Meet. Mayo Clin. *24*: 9-11, Jan. 5, 1949.

# Ruptured Duodenal Ulcer Coincident With Gastric Carcinoma

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Lewis A. Smith, *Major, U. S. A. F. (MC)* (2)
Roy B. Cohn, *M. D.* (3)

THE coexistence of duodenal ulcer and gastric carcinoma, as recorded in medical literature, is uncommon. Even less frequent are reports of the rupture of a duodenal ulcer into the peritoneal cavity in the presence of a gastric carcinoma. This case is reported because of its rarity. The only similar case found in the literature was that of McCrea (4) who reported a 59-year-old woman with a carcinoma of the cardia and a perforated ulcer on the anterior wall of the duodenum. The perforation was used for a duodenostomy by Witzel's technic with recovery from the operation.

Bockus (5) states: "I have found that duodenal ulcer patients with marked gastric hyperchlorhydria and hypersecretion rarely die of gastric carcinoma. I have been in the habit of attempting to dispel a cancer phobia in patients with a duodenal ulcer by stating that, in my experience, patients with this disease are much less likely to develop cancer of the stomach than those who have no stomach disease whatever."

Wilbur and Rivers (6) published a record of all patients seen at the Mayo Clinic up to 1932 in whom duodenal ulcer was associated with gastric carcinoma. Their study was chiefly concerned with the possi-

(1) United States Army Hospital, Camp Cooke, Calif.
(2) United States Air Force Hospital, Lackland Air Base, Tex.
(3) Assistant Professor of Surgery, Stanford University School of Medicine, San Francisco, Calif.

(4) McCrea, E. D.: Gastric carcinoma with duodenal ulcer. Brit. M. J. *1*: 252, Feb. 9, 1935.

(5) Bockus, H. L.: Gastro-enterology, Volume I. W. B. Saunders Co., Philadelphia, Pa., 1946. p. 647.

(6) Wilbur, D. L., and Rivers, A. B.: Association of duodenal ulcer and gastric carcinoma. Proc. Staff Meet. Mayo Clin. 7: 241-243, Apr. 27, 1932.

bility of substantiating their clinical impression that a patient with an active duodenal ulcer and high gastric acidity is less subject than a normal person to the development of gastric carcinoma. The series consisted of 33 cases; 19 with active duodenal ulcers; 6 with perforating or subacute ulcers; and 7 with healed ulcers. In 10 the duodenal ulcer was an incidental lesion. Three of the patients had achlorhydria; in these three the carcinoma was inoperable. Nine patients had free gastric acidity of 50 degrees or more; of these, 5 had carcinoma of the stomach; the other 4 were reported as having malignant gastric ulcers.

In a later series from the Mayo Clinic, Fischer, Clagett, and McDonald (7) reviewed the records of 48 proved cases of duodenal ulcer associated with gastric malignancy. These cases were collected from June 1911 to January 1945, in a series of about 45,000 patients with duodenal ulcer and 13,000 with malignancy of the stomach. The incidence of malignant gastric disease associated with duodenal ulcer was 0.1 percent. The incidence as related to sex and age was not unusual and there appeared to be no correlation between gastric acidity and the nature of the gastric lesion. In 4 patients the duodenal ulcers were described as subacute or perforating, the remainder being healed or scarred at the time of operation. Of the gastric lesions, one was a lymphosarcoma, one an unclassified high-grade malignant tumor, and the remainder were carcinomas. The authors found no explanation for the infrequency of gastric malignancy associated with duodenal ulcer. They noted that the survival rate in this group of patients was much higher than that usually associated with carcinoma of the stomach and they explained this by the fact that patients with duodenal ulcer are "stomach-conscious" and inclined to consult a physician earlier.

## CASE REPORT

A 68-year-old white man entered the Letterman Army Hospital on 13 December 1948 complaining of difficulty in swallowing and loss of weight. The onset of dysphagia dated from September 1947 and it became more severe in May 1948 following an automobile accident in which he suffered a contused chest. At that time a study of the upper gastrointestinal tract revealed a normal esophagus and stomach; the first portion of the duodenum was deformed and presented an ulcer crater on its lesser curvature; and there was a diverticulum on the pancreatic surface of the descending portion of the duodenum. There was no 6-hour gastric residue. The physical examination and laboratory studies were otherwise not remarkable. The patient was discharged within a few days.

Dysphagia progressed so that at the time of the present admission to the Letterman Army Hospital the patient had difficulty swallowing many foods, especially meat; food seemed to "stick" at the level of the manubrium. In the 4 months prior to entry he had noted a diminishing

(7) Fischer, A. (Rochester, Minn.); Clagett, O. T.; and McDonald, J. R.: Coexistent duodenal ulcer and gastric malignancy. Surgery *21*: 168-174, Feb. 1947.

gastric capacity. For 3 weeks before admission he had taken frequent small amounts of soup, milk, and crackers and stated that in this period he had vomited about half the ingested food. In the 48 hours prior to admission, he had retained only half a cup of liquid. He had lost 35 pounds in the preceding year, 15 of which had been lost in the 3 weeks before admission. Pain was absent.

*Physical examination* revealed a poorly nourished man of 67½ inches, weighing 120 pounds. He showed evidence of marked weight loss but was not in acute distress. There were multiple firm nodes 0.5 cm. in diameter in the left anterior cervical triangle and an ill-defined area of increased resistance below the liver margin on the right side. No rectal shelf mass was felt.

*Laboratory findings.*—The hemoglobin was 16.8 grams. The leukocyte and differential counts were normal.

*Course in hospital.*—It was thought the patient had a tumor of the stomach and that his dysphagia was caused by esophageal spasm. Gastrointestinal roentgenograms made elsewhere in May 1948 were not available to us. The patient was scheduled for roentgenologic study of the gastrointestinal tract, gastroscopy, and gastric analysis. Subsequent developments prevented the gastroscopy and gastric analysis. A gastrointestinal series was obtained on the day following admission. There was a large residue of fluid and food in a greatly dilated esophagus. The lower esophagus showed a smoothly marginated abrupt constriction, and the distal 2 cm. were about half the normal caliber. The appearance was that of cardiospasm although the barium entered the stomach somewhat more readily than it commonly does in that condition. The fundus of the stomach had an irregular, greatly reduced lumen and contained only a small gas bubble. The intermediate part showed a narrowed lumen with unusually irregular margins. The remainder of the stomach was uniformly narrowed to a diameter of about 1 cm.; this portion was movable but not distensible. There was an ulcer crater 1 cm. in diameter in the deformed first portion of the duodenum, and a small diverticulum was found in the second portion. The stomach emptied readily. Impressions from the roentgenologic study were (1) cardiospasm, (2) extensive carcinoma of the stomach, (3) duodenal ulcer, and (4) duodenal diverticulum (figs. 1 and 2).

On the day following the roentgen examination the patient suddenly developed excruciating abdominal pain which began without nausea or vomiting, and which became progressively more severe. The temperature, pulse, and respiration were 98.6° F., 100, and 20, respectively. The abdomen exhibited boardlike rigidity and accentuated tenderness in the upper half. A roentgenogram of the abdomen showed no free air, but did show a small collection of free opaque material overlying the gallbladder region, believed to be barium liberated as a result of rupture of the duodenal ulcer. The esophagus still contained much residual barium. A trace of barium and gas remained in the stomach and a large

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amount of barium was present in the ascending and transverse colon (fig. 3). A diagnosis of perforated viscus was made and the patient was prepared for operation, which was begun 5 hours after the perforation occurred.

*Figure 1.—Roentgenogram showing the dilated esophagus, filling defect in the gastric fundus, and constriction of the pyloric antrum.*

*Figure 2.—Roentgenogram showing filling defect of the gastric fundus, constriction of the pyloric antrum, crater in the duodenum, and diverticulum of the duodenum. Note the small amount of gas in the fundus in both figures 1 and 2.*

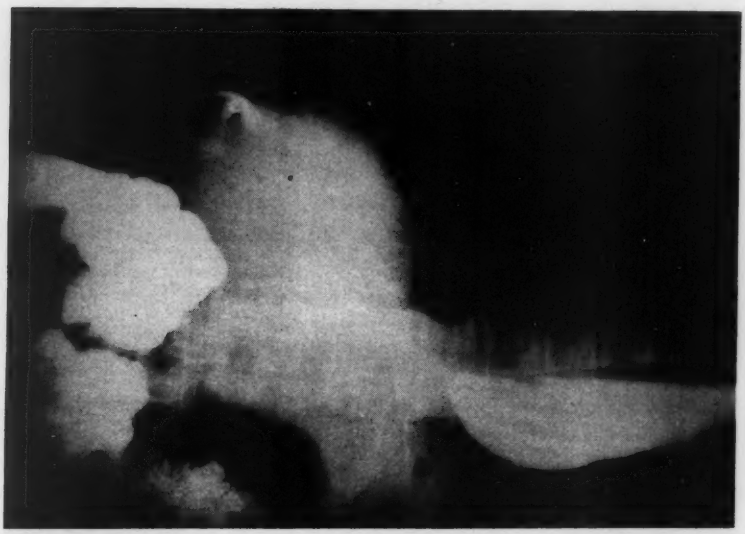

*Figure 3.—Roentgenogram of the abdomen (patient in left lateral decubitus position) taken 24 hours after gastrointestinal series shown in figures 1 and 2. Note residue of barium in the esophagus, insignificant gas bubble in the stomach and the small collection of barium overlying the region of the gallbladder.*

*Operation.*—On opening the peritoneal cavity a large amount of cloudy fluid escaped. The duodenum was readily located and a large anterior perforated ulcer was seen. A hard infiltrating tumor was found in the lesser curvature of the stomach extending about the cardia and attached to the posterior abdominal wall in the region of the lesser sac. The duodenum was severed across the ulcer and the end closed satisfactorily. The stomach was resected and an esophagojejunostomy was performed followed by an enteroenterostomy between the loops of the jejunum about 25 cm. below the esophagojejunal stoma. The patient was returned to the ward in fairly good condition.

*Pathologist's report.*—The stomach measured 25 cm. along the greater and 10 cm. along the lesser curvature. The musculature of the stomach wall was thickened and disrupted by a light gray tissue which spread into the regional fat along the lesser curvature. In this fat there were numerous rounded nodules of firm, light gray tissue measuring up to 0.4 cm. in diameter. There was no alteration in the mucosa of the pyloric region.

Microscopic sections showed autolysis in much of the stomach tissue. The tumor in the cardiac portion of the stomach was diffusely infiltrating, disrupting the muscular layers (fig. 4). The mucosa was not ulcerated. The cells were columnar, with hyperchromatic nuclei, and

they formed abortive glandular structures in a dense fibrous stroma. Many lymphatic channels contained tumor cell clusters; the tumor extended into the serosal fat and partially replaced several lymph nodes in this fat. The tumor involved the proximal and distal margins of the resected stomach but did not invade the duodenum. The pyloric region contained invasive tumor identical with that seen in the cardiac portion of the stomach. The distal end of the specimen included the

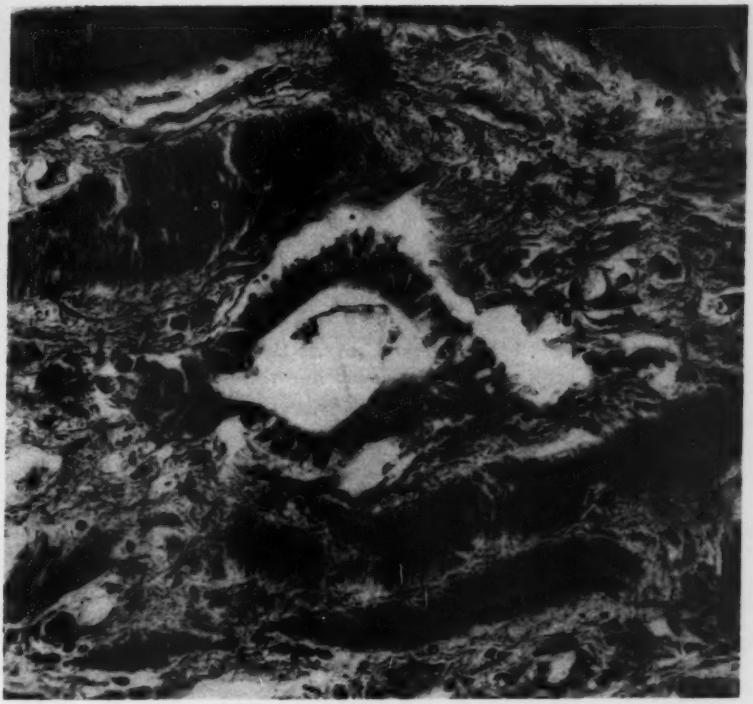

*Figure 4.—Section of stomach showing tumor invasion between muscle bundles in an adenomatous pattern and as isolated goblet cells.*

margin of a peptic ulcer; the mucosa was replaced by necrotic material, beneath which was granulation tissue.

The pathologic diagnoses were (1) adenocarcinoma of the stomach, with regional lymph node metastases, and extension to proximal and distal margins of stomach, and (2) peptic ulcer of first portion of duodenum, chronic.

*Postoperative course.*—The patient had an uncomplicated convalescence. Gastric suction was discontinued on the sixth postoperative day; a liquid diet was started and on the tenth day a soft diet was

instituted with interval liquid feeding. The patient continued to have dysphagia accompanied by a sour taste in his mouth from retching when he ate too fast. Roentgenologic studies on the twenty-second postoperative day revealed narrowing at the distal end of the esophagus, with moderate stenosis at the site of anastomosis. The patient was discharged on the thirtieth postoperative day at which time he was able to take small feedings. He had neither lost nor gained weight since starting the soft diet.

His subsequent course was slowly downhill and he was readmitted to Letterman Army Hospital on 14 June 1949 complaining of dysphagia, regurgitation, and vomiting of most of his food. He had lost 12 pounds since January 1949 and was becoming weaker. He had a good appetite which he could not satisfy.

Physical examination revealed marked emaciation; the weight was 108 pounds. There was evidence of ascites. The hemoglobin was 12.1 grams. A roentgenogram of the abdomen revealed obliteration of renal and psoas shadows by a diffuse haze, through which could still be seen the small collection of barium over the gallbladder region. Barium study revealed considerable dilatation of the esophagus, a 1 cm. wide annular filling defect immediately above the esophagojejunal stoma, and almost complete stenosis of the latter. This appearance was interpreted as resulting from continued growth of the tumor left in the esophagus at the operation.

Forty-five centimeters from the incisor teeth a marked constriction of the esophagus with friable mucosa which bled easily was seen through the esophagoscope. Smears from this area were positive for malignant cells. The patient attempted unsuccessfully to swallow a thread for subsequent dilatation of the esophagus with a Plummer bougie. He continued his downhill course and died on 2 August.

*Autopsy.*—The body weighed 94 pounds. The significant findings were stenosis of the esophagojejunal stoma to a circumference of 2 cm. Malignant cells and moderate connective tissue reaction were present at the site of anastomosis. Small metastases were found in the pancreas, on the peritoneum, and on the inferior surface of the diaphragm. The liver was free of metastases.

## COMMENT

There were unusual as well as typical features in this case of uncommonly associated diseases. Although the patient's chief complaint pointed toward an esophageal disease, his appearance and lesser complaints suggested a malignant tumor of the stomach. As is frequently the case, he gave no history to indicate an impending perforation of a duodenal ulcer, and the presence of the ulcer was unsuspected until the duodenum was examined roentgenographically. The symptoms and physical findings of his perforation were characteristic; the roent-

genographic appearance was less typical in that the material which leaked was not gas but barium. The absence of free gas in the peritoneal cavity is perhaps to be explained by the large filling defect in the stomach which replaced the customary magenblase; virtually no gas was available to escape through the perforation. It is noteworthy that this elderly, emaciated patient, with a 5-hour-old perforation of the duodenum, could withstand so well the extensive operation which was necessary. We are in agreement with Bisgard and Overmiller *(8)* that radical gastric operations are indicated in visceral perforation in the presence of carcinoma of the stomach.

*(8)* Bisgard, J. D., and Overmiller, W.: Emergency gastrectomy for acute perforation of carcinoma of stomach, with diffuse soiling of free peritoneal cavity. Ann. Surg. *140*: 526-530, Oct. 1944.

# Use of Tantalum Screen in Repair of Nasal Deformities

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MANY substances have been used in attempts to alter nasal contour, especially defects of the saddlenose variety. The list is long and varied. To Fomon *(1)* must be given credit for the history and detailed description of the various types of implants that have been used in building up the nasal dorsum. He stated that Nelaton in 1900 introduced autoplastic cartilage which most nearly meets the qualifications of an "ideal" nasal transplant. Mention is also made of vaseline offered by Gersung in 1900, paraffin by Eckstein in 1901, celluloid by Foderl in 1903, elephant ivory by Joseph in 1918, periosteum by Reverdin in 1879, muscle by Bighard, fascia by Koch in 1914, bundles of catgut by Rueda in 1913, and bovine cartilage by Stout in 1933.

Peer *(2)* endorsed the use of isografts of preserved costal cartilage from fresh autopsy material preserved in aqueous merthiolate solution and refrigerated. Fomon et al. *(3)* in 1945 advocated the use of cancellous bone obtained from the crest of the ilium. In 1949 Cottle et al. *(4)* reported 10 patients in whom this type of implant was used and stated that they had never seen a bone graft performed, in the manner they describe, which did not unite successfully. We agree with Fox *(5)* that the ideal tissue implant has not yet been found but believe that tantalum approaches fulfillment of the requirements for such a medium as laid down by Fomon *(1)*.

First described by Ekeburg in 1802, this metal has many desirable physical qualities. In its resistance to body chemistry it compares

*(1)* Fomon, S.: The Surgery of Injury and Plastic Repair. Williams & Wilkins Co., Baltimore, Md., 1939. pp. 697-699.

*(2)* Peer, L. A.: Fate of autogenous septal cartilage after transplantation in human tissues. Arch. Otolaryng. 34: 696-709, Oct. 1941.

*(3)* Fomon, S.; Luongo, R. A.; Schattner, A.; and Turchik, F.: Cancellous bone transplants for correction of saddle nose. Ann. Otol., Rhin. & Laryng. 54: 518-533, Sept. 1945.

*(4)* Cottle, M. H.; Loring, R. M.; Cohen, M. H.; and Kirschman, R.: Cancellous bone grafts in nasal repair. Ann. Otol., Rhin. & Laryng. 58: 135-146, Mar. 1949.

*(5)* Fox, S. L.: Tantalum in rhinoplastic surgery. Ann. Otol., Rhin. & Laryng. 58: 40-54, Mar. 1949.

with glass, it tolerates most acids in high concentrations, and is attacked only by strongly alkaline salts. Burke (6), Pudenz (7), Craig (8), and Carney (9) believed it to be a "physiologically inert" metal. The oxide as formed, covers the metal with a thin, strong, and tenacious coating that is impervious to corrosion. According to Gerry (10) it becomes surrounded in the body by a thin fibrous connective tissue envelope composed of healthy fibroblasts. The metal may be used in infected fields because of its impermeability. It now has a wide range of application in surgery. In neurosurgery for the repair of peripheral nerves Spurling (11) (12), Olson (13), Schnitker (14), and Scarff (15) reported promising results with end-to-end anastomosis.

Kazanjian and Holmes (16) and Gardner (17) have reported the use of tantalum in the repair of skull defects following osteomyelitis and associated operations. Sheehan (18) described the use of tantalum wire in the correction of facial paralysis. Goodale (19) in an article on establishing drainage following radical frontal sinus operations used tantalum foil to insure a patent nasofrontal duct. Newman (20) published the first report on the use of tantalum in the form of wool to correct facial and cranial defects. Fox (5) described seven cases in which tantalum wool was employed in the correction of saddlenose deformity.

We use tantalum in the form of a mesh or screen, believing that in this form nutritive and fixative elements easily pass through the implant, fixing and immobilizing it in the tissues. The screen is readily

(6) Burke, G. L.: Corrosion of metals in tissues; and introduction to tantalum. Canad. M. A. J. 43: 125-128, Aug. 1940.

(7) Pudenz, R. H.: Repair of cranial defects with tantalum; experimental study. J. A. M. A. 121: 478-481, Feb. 13, 1943.

(8) Craig, W. M.: War wounds of peripheral nerves. U. S. Nav. M. Bull. 41: 613-624, May 1943.

(9) Carney, H. M.: Experimental study with tantalum. Proc. Soc. Exper. Biol. & Med. 51: 147-148, Oct. 1942.

(10) Gerry, R. G.: Simplified technique for fabrication of tantalum skull plates. U. S. Nav. M. Bull. 46: 1499-1505, Oct. 1946.

(11) Spurling, R. G.: Symposium on war surgery; use of tantalum wire and foil in repair of peripheral nerves. S. Clin. North America 23: 1491-1504, Dec. 1943.

(12) Spurling, R. G.: Peripheral nerve surgery—technical considerations. J. Neurosurg. 1: 133-148, Mar. 1944.

(13) Olson, C. T.: Place of tantalum in surgery. Indust. Med. 13: 917-920, Nov. 1944.

(14) Schnitker, M. T.: Principles of treatment in peripheral nerve injuries. Northwest Med. 43: 5-9, Jan. 1944; also Bull. U. S. Army M. Dept. 73: 53-61, Feb. 1944.

(15) Scarff, J. E.: Surgical treatment of injuries of brain, spinal cord, and peripheral nerves. Surg., Gynec. & Obst. 81: 405-424, Oct. 1945.

(16) Kazanjian, V. H., and Holmes, E. M.: Reconstruction after radical operation for osteomyelitis of frontal bone; experience in 38 cases. Surg., Gynec. & Obst. 79: 397-411, Oct. 1944.

(17) Gardner, W. J.: Use of tantalum for repair of cranial defects in infected cases. Cleveland Clin. Quart. 13: 72-87, Apr. 1946.

(18) Sheehan, J. E.: Unilateral facial paralysis; correction with tantalum wire; preliminary report on 8 cases. Lancet 1: 263-264, Feb. 23, 1946.

(19) Goodale, R. L.: Use of tantalum in radical frontal sinus surgery. Ann. Otol., Rhin. & Laryng. 54: 757-762, Dec. 1945.

(20) Newman, J.: Use of tantalum for facial and cranial defects. Am. J. Surg. 73: 499-502, Apr. 1947.

adaptable and easily made to conform to the varied sizes, forms, and shapes indicated. It has body enough to be supportive, yet is malleable to the extent that it may be molded to "the last touch" contour even after it has been placed in the tissues. This does away with much manipulation incident to the removal, remodeling, and reinserting procedures. It is essential, however, that no part of the implant be left uncovered in the nasal fossas because the mucoperichondrium will not spontaneously close over even small exposures. There is no postoperative reaction, very little swelling, and postoperative tenderness subsides rapidly.

We have had patients who had been subjected to trauma after leaving the hospital, who with nothing more than external manual manipulation over the implant again presented pleasing contours. The screen was

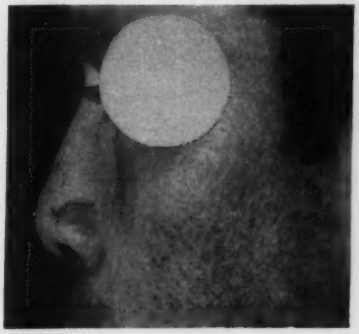

*Figure 1.—Case 1. Prior to lengthening of the columella, elevation, and advancement of tissue at base of lobule.*

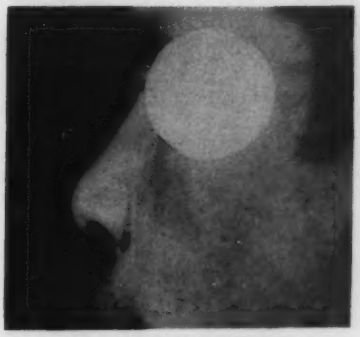

*Figure 2.—Case 1. After columellar correction and implantation of tantalum screen.*

*Figure 3.—Case 1. Roentgenogram showing screen in situ.*

woven from No. 000 catgut-sized tantalum surgical wire on a two-harness hand loom making a tabby weave at 20 strands per inch with every fourth dent double sleighed.

## CASE REPORTS

*Case 1.*—A 28-year-old sailor stated that he had always had a "flattened nose." He had a rhinoplasty with a cancellous bone implant at another hospital in 1948. On 19 January 1950 elongation of the columella with tissue advancement of the base for correction of a retracted columella and acute columella-labial angle was performed. On 27 April 1950 a one-

piece tantalum screen was implanted to raise the tip, correct maxillary recession, and reinforce the columella. The postoperative course was smooth and there was minimal tenderness and swelling. The wire exposed in the left vestibule was clipped close. The mucosa was elevated and snugly approximated (figs. 1, 2, and 3) *(21)*.

*Case 2.*—A 28-year-old flyer sustained an injury to his nose in an airplane accident with a resultant saddle-type deformity. Five months later he had an autoplastic rib cartilage implant placed in the dorsum and a submucous resection of the nasal septum. The cartilage was absorbed with recurrence of the deformity. In June 1949 a cancellous bone implant from the crest of the ilium was performed. This absorbed within 3 months with return of the deformity. A lateral osteotomy to narrow the nasal bony arch was performed at this time. On 6 July 1950 a tantalum screen implant was placed in the nose to restore the dorsal contour (figs. 4, 5, and 6).

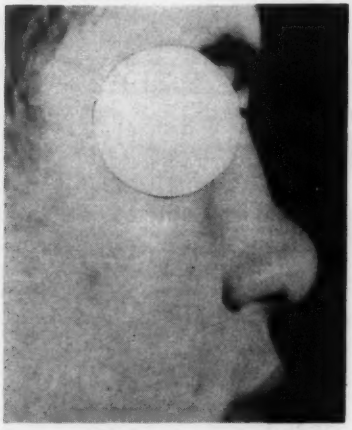

*Figure 4.—Case 2. After absorption of cancellous bone graft.*

*Figure 5.—Case 2. After tantalum implant.*

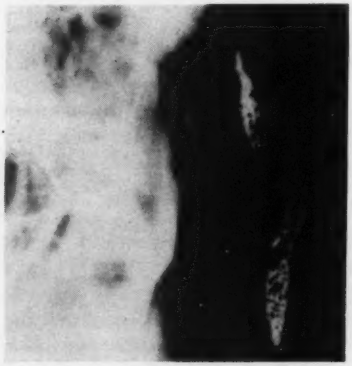

*Figure 6.—Case 2. Roentgenogram showing tantalum screen in situ.*

*(21)* As this article was being completed, this patient presented himself with an angular deviation of the mobile septum to the left following a fall. Manual manipulation readily restored the columella to its normal alinement.

*Case 3.*—A 23-year-old sailor, who sustained a nasal injury at the age of 16 years, had a submucous resection with preserved septal cartilage as a septocolumellar implant in April 1950 which absorbed leaving marked columellar retraction. The dorsum presented a marked depression at the osteocartilaginous juncture. The base of the nose was very broad. A one-stage rhinoplasty was performed in July 1950 with a tantalum screen implant in the dorsum and a tubular septocolumellar screen implant based over the septal spine and introduced through the mucobuccal fold above the incisor teeth (figs. 7, 8, and 9).

*Figure 7.*

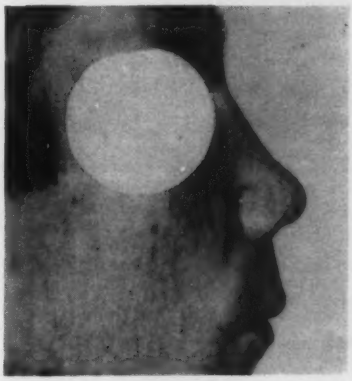

*Figure 8.*

*Figure 7.—Case 3. Prior to insertion of tantalum screen implant.*

*Figure 8.—Case 3. Five weeks after insertion of implant.*

*Figure 9.—Case 3. Roentgenogram showing tantalum screen in situ.*

*Figure 9.*

*Case 4.*—A 39-year-old man had a Killian type submucous resection in 1945 with a resultant saddle, retracted columella, and drooping tip. Apparently no quadrangular cartilage was present. On 15 August 1950 a tantalum screen was introduced into the septocolumellar pocket to advance the columella. On 7 September 1950 a tantalum implant was inserted into the dorsum. The postoperative course was smooth (figs. 10, 11, 12, and 13).

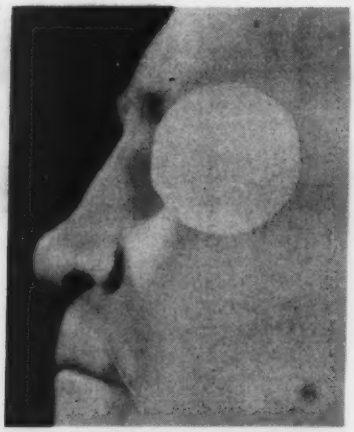

*Figure 10.—Case 4. Prior to tantalum septocolumellar implant.*

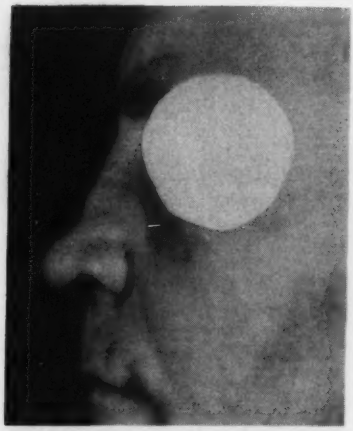

*Figure 11.—Case 4. After septocolumellar implant.*

*Figure 12.—Case 4. After tantalum screen was placed over dorsum.*

*Figure 13.—Case 4. Roentgenogram showing tantalum screen in situ.*

*Case 5.*—A 21-year-old sailor had sustained repeated nasal trauma as a result of wrestling, boxing, and football over a 5-year period. On 17 March 1950 an isoplastic septal cartilage implant was placed into the septum and columella. On 13 September 1950 a rhinoplasty consisting of osteotomy modeling of upper and lower lateral cartilages, and insertion of a tantalum screen above the dorsum, was performed (figs. 14, 15, and 16).

*Figure 14.*

*Figure 15.*

*Figure 14.—Case 5. After insertion of septocolumellar cartilage implant.*

*Figure 15.—Case 5. Two weeks following rhinoplasty and tantalum implant.*

*Figure 16.—Case 5. Roentgenogram showing tantalum screen in place.*

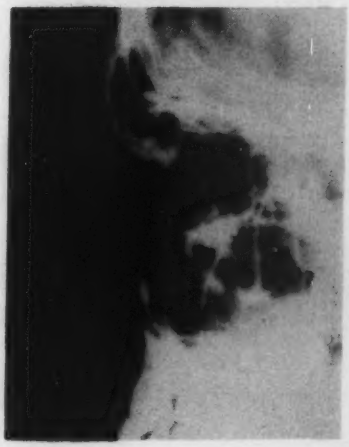

*Figure 16.*

*Case 6.*—An 18-year-old sailor who had been struck on the nose by a 2 by 4 inch piece of wood at the age of 6 years, stated that this was followed by an abscess (septal?), which after healing left a saddle deformity and marked nasal obstruction. He had had some type of operation on the nasal septum when he was 9 years old with no improvement. Examination showed a marked saddle type of deformity and pronounced columellar retraction. The septum was thickened and irregular. Both fossas were inadequate. On 6 April 1950 a submucous resection was performed and preserved septal cartilage implant introduced. On 8 September 1950 rhinoplasty with the insertion of a tantalum screen to bring up the dorsum was performed (figs. 17, 18, and 19).

*Figure 17.*

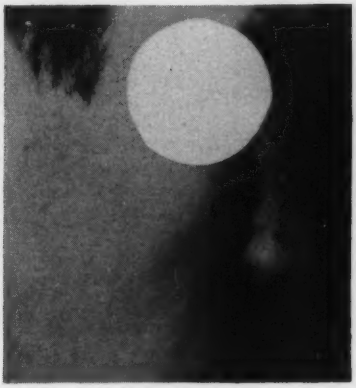

*Figure 18.*

*Figure 19.*

*Figure 17.—Case 6. After insertion of preserved septocolumellar cartilage graft.*

*Figure 18.—Case 6. Two weeks after insertion of tantalum screen.*

*Figure 19.—Case 6. Roentgenogram showing tantalum screen in situ.*

*Case 7.*—A 21-year-old sailor had had a traumatic nasal deformity for 2 years. On 3 August 1950 a tantalum screen septocolumellar implant was inserted. On 17 August 1950 a rhinoplasty was performed. No dorsal implant was necessary (figs. 20, 21, and 22).

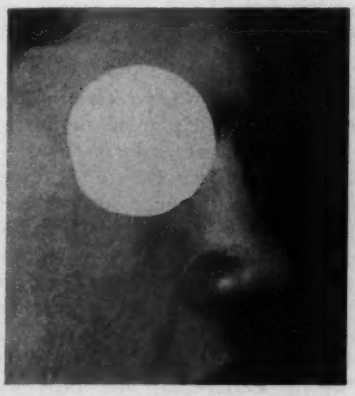

*Figure 20.*

*Figure 21.*

*Figure 20.—Case 7. Prior to septectomy.*

*Figure 21.—Case 7. Following septectomy.*

*Figure 22.—Case 7. Roentgenogram showing tantalum septocolumellar implant in place.*

*Figure 22.*

## DISCUSSION

Seven patients in whom tantalum in the form of a screen was used in the correction of nasal deformities have been presented. Cases 1 and 2 had cancellous bone implants that absorbed, the first operated on elsewhere, the second from our service. These are 2 of 8 patients in whom we have seen return to the original contours following absorp-

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tion of cancellous bone placed in the dorsum. These patients dampened our early enthusiasm for bone implants. The unsatisfactory eventual results following the use of paraffin, celluloid, and ivory are well known. The failure of rib cartilage implants to form an organic union with the nasal bones or become fixed in the tissues leaves these grafts with an undesirable mobility. Curling, twisting, and extrusion have all been observed by those who perform even a few corrective operations.

The use of a tantalum screen in the correction of the retracted columella in cases 1, 3, 4, and 7 illustrates the application of this medium to a very trying deformity. In selected cases we prefer it to cartilage because of its availability which obviates the cartilage bank and the annoyance associated with attempts to recover enough septal cartilage for an implant from an inadequate, thickened, or irregular quadrangular plate. The screen is not as thick as cartilage, resists retraction, is supportive, and does not absorb. As a septocolumellar implant the screen is notched to fit over the nasal spine and kept large enough to reach the dorsum. We have yet to see more than minimal swelling, tenderness, or extrusion of the implant. It is very important to cover the screen completely. In building up the columella-labial angle we find the screen quite suitable, introducing it through the mucolabial fold above the incisor teeth and anchoring it if necessary to the nasal spine.

## CONCLUSIONS

Tantalum screen must be considered in the search for an ideal implant material in corrective nasal operations because it is readily available, adaptable, inert in the tissues, becomes firmly fixed, resists retraction, and lends itself to manual manipulation for the alleviation of subsequent traumatic displacements.

# Calcification of the Pericardium

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Edwin M. Goyette, *Colonel, MC, U.S.A.* (1)
Harry P. Makel, *Major, MC, U.S.A.* (1)

CALCIFICATION of the pericardium is infrequently encountered in military personnel and still less frequently are such persons successfully operated on and returned to full military duty.

## CASE REPORT

A 22-year old white soldier was admitted to this hospital in September 1948 because of ill-defined abdominal pain. His symptoms subsided rapidly without specific treatment. Roentgenographic examination of the chest revealed prominence of the pulmonary conus and extensive calcification of the pericardium encasing almost the entire right ventricle and right auricle, extending to the cardiac apex, and ending abruptly on the diaphragm. The patient had no complaints referable to this condition. He was informed of these findings and surgical treatment was advised. He declined such therapy and was sent to duty and told to return if the condition became symptomatic. About 1 year later he began to note easy fatiguability, shortness of breath, and a feeling of constriction of the chest. Symptoms gradually increased to such a degree that he was quite short of breath on climbing one flight of steps and exhausted on climbing three. About 18 months after discharge he reentered this hospital because of these symptoms. A thorough clinical work-up revealed a radial pulse rate of 84 bilaterally, a blood pressure of 105/65 bilaterally, and mild generalized peripheral adenopathy. The heart sounds were normal. A complete blood count, several liver function tests, sedimentation rate, A/G ratio, and blood serum amylase were normal. The electrocardiogram was normal. The chest roentgenogram is shown in figure 1.

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*Figure 1.—Preoperative roentgenogram of chest showing extensive calcification of the pericardium.*

Cardiac catheterization observations relative to the right ventricle, right auricle, superior vena cava, and femoral artery were made (table 1). Because of repeated bursts of ventricular ectopic beats the catheter was not introduced into the pulmonary artery. The peripheral venous pressure was 206 mm. of water and it exhibited no significant change after exercise. Together, these findings suggested moderate constriction of the right auricle.

TABLE 1.—*Findings on cardiac catheterization*

| Source of specimen | Oxygen content (volume per 100 cc.) | Oxygen saturation (percent) | Pressure |
|---|---|---|---|
| Superior vena cava | 14.1 | 76 | 13/3 |
| Right auricle | 13.0 | 70 | 13/3 |
| Right ventricle | 13.7 | 74 | 13/3 |
| Femoral artery | 18.3 | 99 | ------ |

Surgical exploration through a sternal T-shaped incision with wide exposure of the heart was accomplished. An extensively calcified area

*Figure 2.—Postoperative roentgenogram showing no evidence of pericardial calcification. The right ventricular shadow suggests greater diastolic filling.*

of the pericardium involving the right ventricle, right auricle, superior and inferior vena cava, the inferior border of the heart, and the adjacent diaphragm, was removed. The pericardium of the left ventricle was largely free of calcification. The calcified plaque averaged 0.7 cm. in thickness and was stony hard. No specific cause could be determined. The postoperative course was uneventful. The venous pressure dropped to 94 mm. of water, and the patient returned to duty. The postoperative chest roentgenogram is shown in figure 2.

Holman (3) and others (4) (5) have emphasized the characteristic features and methods for surgical correction of this condition. The patient herein reported had a marked pericardial calcification with early mild constriction and with symptoms which were completely relieved by operation, allowing his return to full military duty.

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(3) Holman, E.: Recognition and correction of constrictive pericarditis. J. Thoracic Surg. *18*: 643-651, Oct. 1949.

(4) Paul, O.; Castleman, B.; and White, P. D.: Chronic constrictive pericarditis; study of 53 cases. Am. J. M. Sc. *216*: 361-377, Oct. 1948.

(5) White, P. D.; Alexander, F.; Churchill, E. D.; and Sweet, R. H.: Chronic constrictive pericarditis over left heart chambers and its surgical relief. Am. J. M. Sc. *216*: 378-388, Oct. 1948.

# Correction of Malocclusion After Unreduced Fractures

Ben W. Oesterling, *Captain, DC, U.S.N.* (1)

William B. Johnson, *Commander, DC, U.S.N.* (2)

IN THE treatment of traumatic injuries of the facial bones, the objectives should be: (1) restoration of the function of the jaws, (2) restoration of the occlusion of the teeth, and (3) normality of of the facial contour. When compromises between these objectives are necessary, the patient's desires and best interest must be considered and weighed. Facial and jaw fractures are seldom fatal, but a deformity of the face is of great concern to a patient, and can cause him much mental anguish. Facial deformities and additional operations are held to a minimum if prompt attention is given to even the slightest possibility or suspicion of a maxillofacial fracture. For these reasons, consultation with the dental surgeon should not be deferred in cases in which a facial bone fracture appears to be an insignificant condition in comparison with the patient's general condition.

## CASE REPORT

A sailor was admitted to a U. S. naval hospital after having fallen from the gangway of a ship, striking his head and face on the concrete dock to which the ship was moored. On admission he was semiconscious and in shock. He was given 1 unit of plasma. His right wrist was fractured and he was bleeding from the nose and mouth. There was a deep wound in the lateral area of the right frontal bone. The right eye was closed and the orbital tissues were markedly edematous. The right eye was ecchymotic and was deviated outward and upward. There was no internal rotation and only limited external rotation. He could not move his eye downward. The pupils were dilated. The right ear drum was edematous. Palpation and observation of the face revealed a depressed fracture of the right zygoma. Because of the position of the right upper eyelid and the lowered level of the right eyeball, it was thought that the floor of the orbit had been fractured and forced downward. A roentgeno-

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(2) U. S. Naval Academy, Annapolis, Md.

gram of the skull showed a comminuted fracture of the right lateral frontal region, with a large linear fracture extending to the left and upward across the frontal region.

Because of the patient's critical condition, only plasma, intravenous feeding, and other supportive treatment were given during the 4 weeks following the accident and prior to consultation with the dental department staff. At that time there was still complete ptosis of the upper lid of the right eye (fig. 1). A lowered level of the right eyeball was considered to be the result of the depressed fracture of the right zygoma,

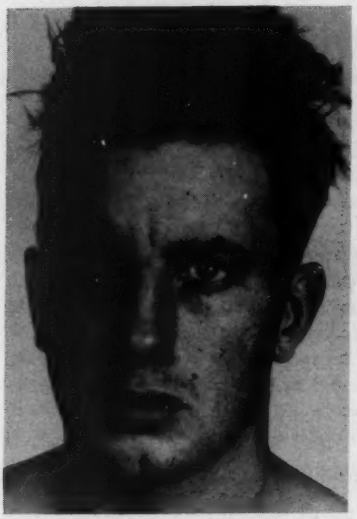

*Figure 1.—Four weeks after injury. Note complete ptosis of the right eye, and the depressed appearance of the facial contour on the right side.*

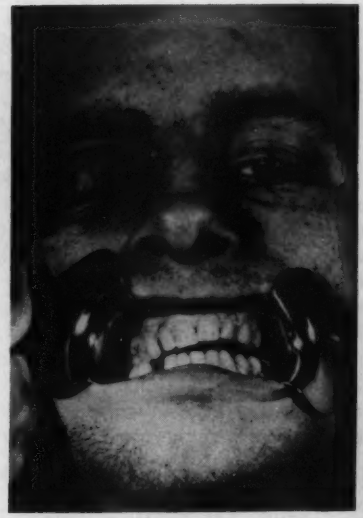

*Figure 2.—Malocclusion caused by fibrous union in the unreduced maxillary fracture.*

discernable by palpation and by the appearance of the face. The upper anterior teeth and the left upper posterior teeth were completely out of occlusion (fig. 2). The buccal cusps of the right posterior teeth were in end-to-end occlusion with the lingual cusps of the lower right posterior teeth. The fractured maxilla was by this time firmly fixed by fibrous union. Roentgenograms showed (1) a depressed fracture of the right zygoma, (2) what appeared to have been a complete horizontal fracture of the maxilla, and (3) a fracture of the right mandibular condyle with no displacement.

*Stage 1 treatment (reduction of the malar fracture).*—Because clinical and roentgenographic examinations showed that the zygomatic fracture

was comminuted, that there was antral involvement, and that the right mandibular condyle was fractured, an intraoral approach was decided on for reducing the zygomatic fracture. Under endotracheal gas and ether anesthesia, an intraoral incision was made and the antral cavity entered. The fragments of the fractured zygoma were elevated into proper position. A Penrose drain was inserted and the fracture immobilized with an iodoform gauze pack. At the time of this operation, the fracture line on the right side of the maxilla was apparent, but the dense fibrous union which had already taken place prevented reduction of the maxillary fracture by manual manipulation at this stage. Recovery from the reduction of the zygomatic fracture was uneventful and the cosmetic result was good in that most of the facial deformity was corrected.

*Stage 2 treatment.*—There remained the problem of correcting the malocclusion and the residual slight facial deformity not correctible by the first operation and which had resulted from the fibrous union of the fractured maxillary fragment in the depressed position. The oral surgeon decided against an extraoral appliance because of the other head injuries the patient had sustained. The prosthodontist therefore took hydrocolloid impressions from which a two-piece acrylic intraoral splint was made. The appliance (fig. 3) was fitted and wired to the maxilla. One half of the appliance was attached to the teeth of the uninjured maxilla, which served as the fixed base; the other part was attached to the teeth of the fractured maxilla. By means of a jackscrew connecting the two

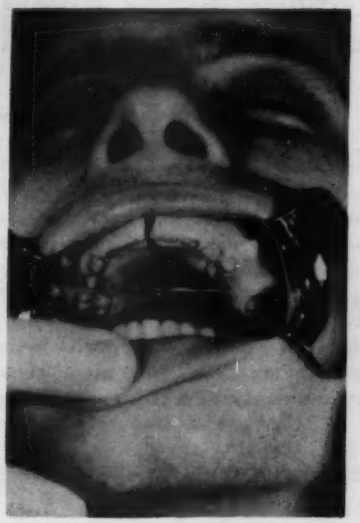

*Figure 3.—The prosthetic appliance with jackscrew.*

*Figure 4.—Fixation of the maxilla and mandible with continuous loop wiring and elastic band traction.*

parts of the appliance, the displaced fragment of the maxilla was moved, over a period of 1 week, until the cusps of the right maxillary teeth had passed over the corresponding cusps of the mandibular teeth. The splint was then removed. Further correction, consisting of traction into correct occlusal position with the cusps as guide, was effected by continuous loop wiring and rubber-band traction (fig. 4) and was complete

*Figure 5.—Occlusion corrected and all intraoral appliances removed.*

*Figure 6.—Patient's appearance on release from the hospital.*

at the end of 3 weeks. The patient was released with the occlusion and the facial deformity corrected (figs. 5 and 6). While under treatment for the facial deformity and the malocclusion, there was a gradual return of function of the external ocular muscles and of the upper lid. At the time of discharge he had almost fully recovered.

## SUMMARY

A facial deformity and malocclusion, the result of unreduced zygomatic maxillary fractures, were corrected by means of (1) intraoral operation and (2) the use of an acrylic intraoral splint with jackscrew, followed by intermaxillary fixation.

# Wolff-Parkinson-White Syndrome

## Report of Two Cases

Jacob J. Robbins, *Lieutenant Commander, MC, U. S. N.* (1)

EVER since the first cases of short P-R interval associated with prolonged QRS complexes in the absence of demonstrable heart disease were first clearly described and delineated by Wolff, Parkinson, and White (2), many reports of similar cases have established this syndrome as a fairly common clinical entity, usually referred to as the Wolff-Parkinson-White syndrome. The purpose of this article is (1) to report two cases of this syndrome in which fairly complete electrocardiographic studies were made with unipolar and precordial leads (the literature contains only one such previous study (3)) and (2) to summarize the facts concerning this abnormality which appear to have been established and to indicate the varying opinions in matters still in doubt.

### CASE REPORTS

*Case 1.*—A 19-year-old man was hospitalized because of general malaise and weakness of 10 days' duration. His illness started with a sore throat and fever but these had subsided at the time of admission. He gave no history of chorea, rheumatic fever, scarlet fever, tachycardia, or other serious illness. His health record showed no previous hospitalization, but on physical examination on enlistment many extrasystoles were noted. His temperature was 98.6° F.; pulse rate, 80; and respirations, 20. There was no swelling nor limitation of motion of any joints. The lungs were clear and there was no lymphadenopathy. Although the heart sounds were distinct and there were no murmurs, the rate, rhythm, and force were grossly irregular and there was a pulse deficit of about 20 beats per minute (80 at the apex and 60 at the radials). The blood

(1) U. S. S. *Shenandoah.*

(2) Wolff, L.; Parkinson, J.; and White, P. D.: Bundle-branch block with short P-R interval in healthy young people prone to paroxysmal tachycardia. Am. Heart J. 5: 685-704, Aug. 1930.

(3) Rosenbaum, F. F.; Hecht, H. H.; Wilson, F. N.; and Johnston, F. D.: Potential variations of thorax and esophagus in anomalous atrioventricular excitation (Wolff-Parkinson-White syndrome). Am. Heart J. 29: 281-326, Mar. 1945.

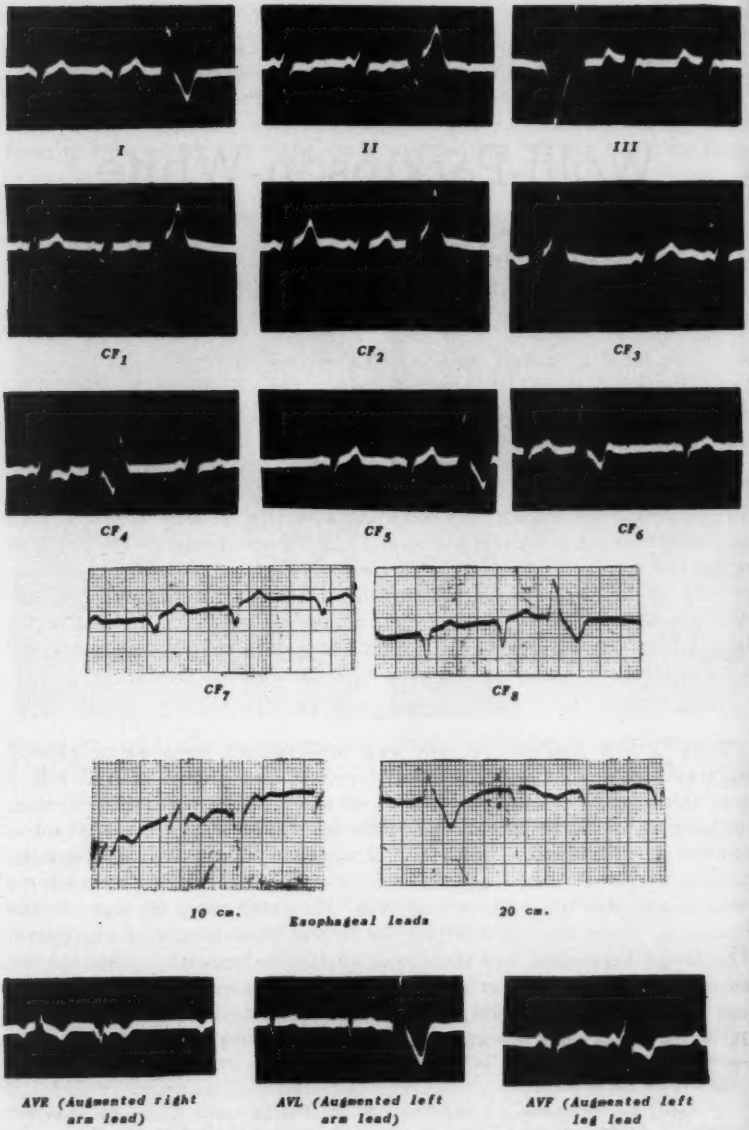


*Figure 1.—Case 1. Most complexes show typical Wolff-Parkinson-White configuration although there are some normal complexes and many ventricular extrasystoles. Note right axis deviation similar to that found in right bundle-branch block. The absence of R-waves in left lateral leads might also suggest myocardial infarction.*

pressure was 140/80. Routine laboratory studies were negative. The sedimentation rate was 6, and remained within normal limits throughout his stay in the hospital. A roentgenogram of the chest showed no cardiac enlargement and the silhouette was normal.

An electrocardiogram (ECG) showed many ventricular extrasystoles, probably arising in the right ventricle, which accounted for the irregular heart action (fig. 1). The supraventricular complexes were typical of the Wolff-Parkinson-White syndrome. The P-R interval was 0.09 second in duration; the QRS measured 0.14 second. There was typical slurring of the ascending limb of the R-wave in leads 1 and 2. The T-waves were upright in $CF_1$, $CF_2$, and $CF_3$, deeply inverted in $CF_4$ and upright again in $CF_5$, $CF_6$, $CF_7$, and $CF_8$. R-waves were absent in $CF_7$ and $CF_8$. Repeated tracings taken while the patient was in the hospital showed little essential change from the original findings except for marked variation in curves which approached normal configuration. The administration of 0.3 gram of quinidine hourly for 4 doses resulted in practically normal tracings (fig. 2), but on the following day these had returned to the original forms. Atropine, digitalis, and exercise were prescribed

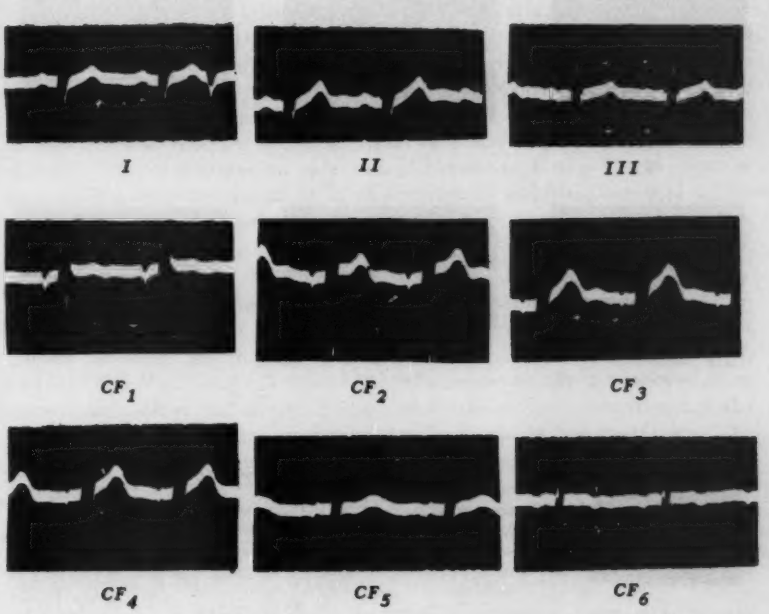


*Figure 2.—Case 1. ECG taken after the administration of quinidine. The tracing is within normal limits except for the diphasic T-waves in $CF_6$.*

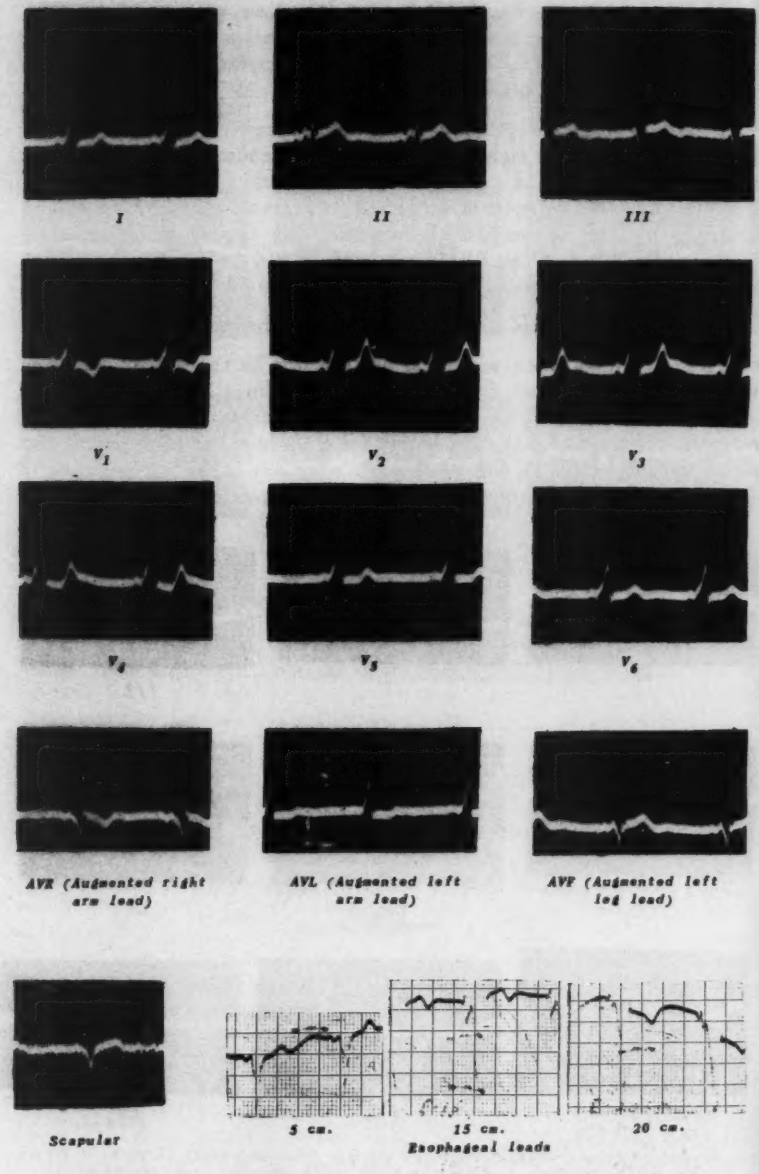


*Figure 3.—Case 2. All complexes were of the Wolff-Parkinson-White type. The P-R interval was 0.08 second; the QRS complex 0.16 second. Note the left axis deviation and general resemblance of tracing to those seen in left bundle-branch block.*

but had no appreciable effect. In the 5 months of observation the patient had no episodes of tachycardia and after recovering from his pharyngitis he was free from symptoms in spite of unrestricted activity.

*Case 2.*—A 20-year-old man was admitted to the hospital complaining of painful swelling of both ankles of 7 days' duration. History revealed that 6 months previously, he had similar complaints and was hospitalized aboard ship for 3 weeks. He denied rheumatic fever, scarlet fever, or other serious illness.

His temperature, pulse, and respirations were normal. His blood pressure was 110/70. There was a diffuse inflammatory swelling of both ankle joints with tenderness and restriction of motion. The sedimentation rate was 19. The white blood cell count was 8,000 with a normal differential count. A roentgenogram of the chest was normal. The ECG showed curves typical of the Wolff-Parkinson-White syndrome. The P-R interval measured 0.08 second and the QRS, 0.16 second. The ascending limb of the R-waves was slurred and notched in all leads. The ST segments in the precordial leads to the right were depressed. The AVL (augmented left arm lead) resembled $V_6$ suggesting a transverse position of the heart (fig. 3). Quinidine, atropine, digitalis, and exercise were prescribed but produced no appreciable change in the configuration of these curves. The patient was hospitalized for 5 months during which time swelling of the ankle joints recurred. Although roentgenograms showed no bony changes these joints remained enlarged and their range of motion was restricted. At no time were any of the other joints involved. The sedimentation rate varied between 10 and 22. In view of this clinical picture a diagnosis of rheumatoid arthritis was made. The electrocardiographic findings were considered to be incidental.

## DISCUSSION

*Physiology.*—Although several theories explaining the electrocardiographic pattern in the Wolff-Parkinson-White syndrome have been presented the most satisfactory was advanced by Holzmann and Scherf (4) and Wolferth and Wood (5). This theory is based on the hypothesis of an accessory pathway of auriculoventricular conduction through which the cardiac impulse is transmitted prematurely to one of the ventricles. The existence of such accessory neuromuscular connections was demon-

(4) Holzmann, M., and Scherf, D.: Über Elektrokardiogramme mit verkürzter Vorhof-Kammer-Distanz und positiven P-Zacken. Ztschr. f. klin. Med. *121*: 404-423, 1932. Cited by Wolferth, C. C., and Wood, F. C.: Further observations on mechanism of production of a short P-R interval in association with prolongation of QRS complex. Am. Heart J. *22*: 450-457, Oct. 1941.

(5) Wolferth, C. C., and Wood, F. C.: Mechanism of production of short P-R intervals and prolonged QRS complexes in patients with presumably undamaged hearts; hypothesis of accessory pathway of auriculoventricular conduction (bundle of Kent). Am. Heart J. *8*: 297-311, Feb. 1933. Cited by Wolferth, C. C., and Wood, F. C.: Further observations on mechanism of production of short P-R interval in association with prolongation of QRS complex. Am. Heart J. *22*: 450-457, Oct. 1941.

strated by Kent in 1914. Further anatomic basis is given this theory by the studies of Wood, Wolferth, and Geckeler (6), who by serial microscopic sections of the atrioventricular groove were able to identify a "Bundle of Kent" in the heart of a patient who in life showed the anomaly of short P-R intervals and prolonged QRS complexes. Pharmacologic experiments also support this hypothesis because the administration of drugs, such as digitalis, quinidine, and atropine, convert the electrocardiographic pattern to normal, indicating that the accessory pathway may be completely blocked. (In case 1, the administration of quinidine produced an almost normal ECG (fig. 2).) The experimental work of Butterworth and Poindexter (7) appears to have settled the question inasmuch as they were able to produce ECG's with short P-R intervals and prolonged QRS complexes by passing an electric current from the auricles to the ventricles and also produced episodes of tachycardia by reversing the direction of the current.

*Incidence.*—Previous observations that the Wolff-Parkinson-White syndrome occurs only in young persons are discounted by Willius and Carryer (8), who reviewed 65 cases seen at the Mayo Clinic. They found the greatest incidence in the fifth decade, the age group in which the greatest number of ECG's were obtained. Only slightly more than a third of their patients were less than 40 years of age. Other writers (9) pointing to the comparatively large number of reports from military hospitals suggested that certain patients outgrow the abnormal auriculoventricular condition.

*Pathology.*—The relationship of the Wolff-Parkinson-White syndrome to myocardial disease is unexplained. Most authorities agree that the presence of this abnormal electrocardiographic pattern in itself does not constitute heart disease because it has been described in congenital heart lesions as well as in association with rheumatic, syphilitic, hypertensive, and thyrotoxic heart disease (10). Hunter, Papp, and Parkinson (11) reviewed 109 cases and found that 21 had cardiac disease which they considered coincidental. Willius and Carryer, in their series, reported heart disease in 19 out of 65 cases. Slightly more than one-half

(6) Wood, F. C.; Wolferth, C. C.; and Geckeler, G. D.: Histologic demonstration of accessory muscular connections between auricle and ventricle in case of short P-R interval and prolonged QRS complex. Am. Heart J. 25: 454-462, Apr. 1943.

(7) Butterworth, J. S., and Poindexter, C. A.: Short P-R interval associated with prolonged QRS complex; clinical and experimental study. Arch. Int. Med. 69: 437-445, Mar. 1942.

(8) Willius, F. A., and Carryer, H. M.: Cardiac clinics; electrocardiograms displaying short P-R intervals with prolonged QRS complexes; analysis of 65 cases. Proc. Staff Meet. Mayo Clin. 21: 438-444, Nov. 13, 1946.

(9) Littmann, D., and Tarnower, H.: Wolff-Parkinson-White syndrome; clinical study with report of 9 cases. Am. Heart J. 32: 100-116, July 1946.

(10) Bodlander, J. W.: Wolff-Parkinson-White syndrome in association with congenital heart disease; coarctation of aorta; report of case. Am. Heart J. 31: 785-791, June 1946.

(11) Hunter, A. (London); Papp, C.; and Parkinson, J.: Syndrome of short P-R interval, apparent bundle-branch block, and associated paroxysmal tachycardia. Brit. Heart J. 2: 107-122, Apr. 1940.

had attacks of paroxysmal tachycardia and this phenomenon occurred 3 times as often in cases without demonstrable heart disease. One of them (a 25-year-old woman otherwise apparently well) died in an attack of paroxysmal tachycardia. The recent literature records at least 2 similar cases. Certainly the conclusion of Bodlander *(10)* that the strain, of frequent attacks of tachycardia adds a hazard to the prognosis in a patient with an already damaged heart is warranted.

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# Some Unusual Tumors Encountered

Edwin H. Cames, *Medical Director, U.S.P.H.S.* (1)

ONE of the fascinations of surgery is the ever-present possibility of encountering the rarity and the unsuspected. There is satisfaction in confirming a preoperative diagnosis at operation and by microscopic examination, but a great thrill will always be derived from bringing to light a curious specimen from the body of a patient. The three cases presented appear to fall into the latter category.

## CASE REPORTS

*Case 1.*--A 25-year-old white woman was referred to the U. S. Marine Hospital, Chicago, Ill., on 4 June 1944 with the history of a "lumplike" tumor on the anterior surface of the right thigh of 5 weeks' duration, increasing in size and attributed to striking the thigh on a crossbar under her desk whenever she crossed her legs. It was stated that after a new desk was provided, 2 weeks prior to admission to the hospital, the size of the tumor remained stationary.

Examination on admission revealed a mass about 6 by 12 cm. on the anterior aspect of the right thigh in the proximal third. It was firm in consistency, movable, and apparently not connected with the femur. No inguinal adenopathy was present, nor were there any discolorations or ecchymoses over the mass. Routine laboratory findings were negative, and roentgenograms showed no lesions in the femur.

At operation a mass was found situated deeply in the quadratus femoris muscle, with its deepest portion near but not attached to the femur. The tumor mass was ovoid and measured about 8 by 5 cm. It was adherent to surrounding muscle tissue and markedly vascular. Removal was grossly complete.

The pathologic report by Dr. Joseph M. Lubitz was as follows:

"Gross findings: Specimen consists of an ovoid mass of tissue measuring 7 by 4 by 3 cm. There is a fibrous capsule surrounding the mass which shows several tags on various areas. On section,

(1) U. S. Coast Guard Academy Hospital, New London, Conn.

the capsule measures about 2 mm. The bulk of tissue is fairly homogeneous, red-brown and gray in color, is firm, and shows some fibrous interlacing streaks. In the midportion there is an area measuring 2.5 cm. which is somewhat softer and deeper red in color.

"Microscopic findings: The capsule is thick, fibrous, and contains elements of muscle fibers with their attachment to the tumor. The tumor is made up of nests of cells which are surrounded by fibrous tissue. The cells form pseudoacini, each of which is made up of about 4 to 8 cells on cross section and is surrounded by capillaries showing proliferation of the endothelium. The component cell is uniformly large. The cytoplasm is pale staining, vacuolated, and contains some areas of condensation of material. The cell wall is quite indistinct for the most part but has a polyhedral arrangement. Where the cells are detached they tend to be rounded or ovoid. The nucleus is very large, occupying about one-third to one-half of the cell with a sharp nuclear membrane and a vascular chromatin structure. The nucleolus is quite distinct. Mitotic figures are noted here and there throughout the sections. In some places the capillarity is extremely proliferous and here dilated vessels are found which contain a large number of blood cells and blood pigment. Occasionally these tumor cells may be found within the capillaries. Stain with Sudan 3 shows the absence of fat. The exact nature of this tumor is not apparent. The impression is that most likely this tumor is primary at the site where it was found. It is a malignant tumor in the sense that growth is rapid and infiltrating. There is a good likelihood that these cells are derived from the endothelial lining of the capillaries and in many aspects the tumor resembles an endothelioma. Pieces of tissue have been sent to the National Institute of Health and the Tumor Clinic for evaluation, but regardless of the exact classification, this must be treated as a malignant neoplasm and recurrences may be anticipated." (See figs. 1 and 2.)

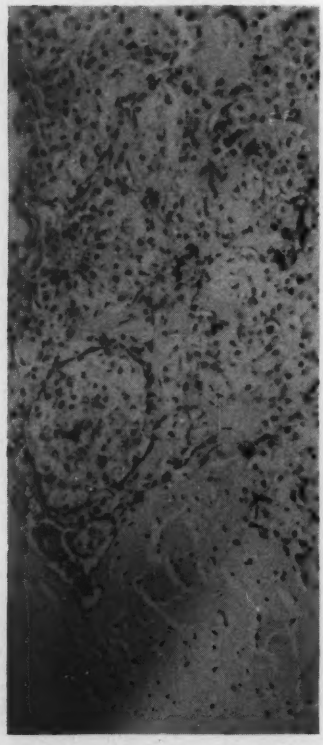

*Figure 1.—Case 1. Photomicrograph of granular myoblastoma of skeletal muscle.*

Because the tumor appeared to be of unusual interest, tissue sections

were sent to various pathologists throughout the country, and their opinions requested. The following comment of Doctor Fred W. Stewart, Memorial Hospital, New York City, is of interest:

"Granular myoblastoma of skeletal muscle. This is a rare lesion and I cannot predict its course. We have almost no cases in this category but have followed one or two from outside the hospital. I believe it will prove benign * * *."

Diagnoses made by other pathologists were: hemangioendothelioma, grade one; metastatic carcinoma, probably of renal origin; mesodermoma; and malignant epithelial neoplasm resembling myoblastoma.

Dr. Lubitz advised that it is now generally agreed that this tumor should be classified as a granular cell myoblastoma. In any event it has not recurred and examination 5 years later showed the right thigh to be of normal female contour and equal in size to the left, with no adenopathy or other evidence of metastasis.

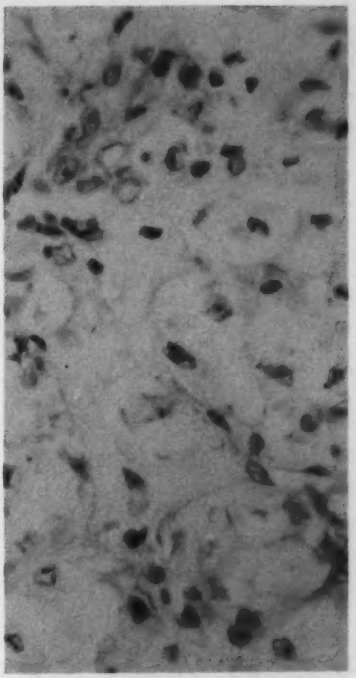

*Figure 2.—Case 1. Photomicrograph of granular myoblastoma of skeletal muscle showing cellular detail.*

*Case 2.*(2)—A white man, aged 60, was admitted to the U. S. Marine Hospital, New Orleans, La., on 26 July 1945 with a history of attacks of cramplike generalized abdominal pain lasting 1 or 2 hours, the first attack having occurred 4 months prior to admission. Ingestion of food appeared to precipitate the attacks and at such times vomiting of ingested food occurred. Bowel habit changes consisted of straining at stool and passing of small stools. No melena was noted.

Physical examination was negative except for what was thought to be an enlarged liver or mass in the liver area. Laboratory findings were negative except for the absence of free hydrochloric acid and the presence of occult blood and *Trichomonas hominis* cysts and *Trichocephalus trichiura* ova in the stool. In roentgenographic studies of the gastrointestinal tract, the only positive findings were a narrowing of the terminal ileum interpreted as a possible ileitis and some signs of avitaminosis.

(2) Originally published in the American Journal of Surgery; Carnes, E. H.: Reticulum cell sarcoma of ileum. Am. J. Surg. 74: 491-493, Oct. 1947.

An exploratory laparotomy revealed a large constricting mass about 8 cm. in diameter in the ileum just proximal to the ileocecal valve. The colon was collapsed and the terminal ileum dilated and hypertrophied. Enlarged lymph nodes were present in the mesentery and in the region of the celiac axis. A resection of the terminal ileum and ascending colon was performed, a Mikulicz type of operation being chosen in view of the condition of the ileum resulting from chronic obstruction.

The pathologic report by Dr. Joseph M. Lubitz was as follows:

"Gross findings: A piece of bowel is removed which includes the terminal ileum and cecum. The ileum is dilated. The serosal covering is dull in color and deeply congested. The mucosal surface is similarly congested. At the terminal ileum, just proximal to the ileocecal valve there is a crater, measuring 7 by 4 cm. At the proximal portion there is an elevated, firm margin surrounding it. In the central portion of this mass, there is a constriction which barely admits the point of a 5 mm. probe. In this portion the tissue is firm, gray, and rubbery hard in consistency. This firmness extends to the wall and forms a node on the mesenteric attachment, measuring 5 by 3 cm. Here, too, the peritoneal surface is congested but is smoother. A mass from the mesentery is submitted, measuring 4 by 1 cm. On section numerous small nodes are found. One, however, is slightly enlarged (measuring 5 by 2 cm.), firm, and pink-gray in color.

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*Figure 3.—Case 2. Photomicrograph of reticulum cell sarcoma, showing tumor cells invading mucosa and muscularis.*

"Microscopic findings: The mucosa is denuded. The entire submucosa is thickened by a uniform type of cell. This extends up to the muscularis and invades it. The cell is large, pale, with prominent nucleolus and well-defined nuclear membrane. The cytoplasm is indistinct and syncytial in nature. The shape of the cell is polyhedral or fusiform. Mitoses are frequent. Occasional giant tumor cells are present. There are in places attempts at alveolar structure but for the most part the cells are undifferentiated.

The tumor has invaded the muscularis. The serosa is edematous and covered with a deposit of fibrin and polymorphonuclear cells (figs. 3 and 4).

"The lymph nodes show a marked follicular hyperplasia of reticulum cells and a rare mitotic figure. However, by means of the ordinary stains and the reticulum stains it has been impossible to locate any tumor cells in several blocks of tissue.

"Diagnosis: Reticulum cell sarcoma; chronic lymphadenitis of mesenteric lymph nodes."

The patient lived for a year following removal of the obstructing lesion.

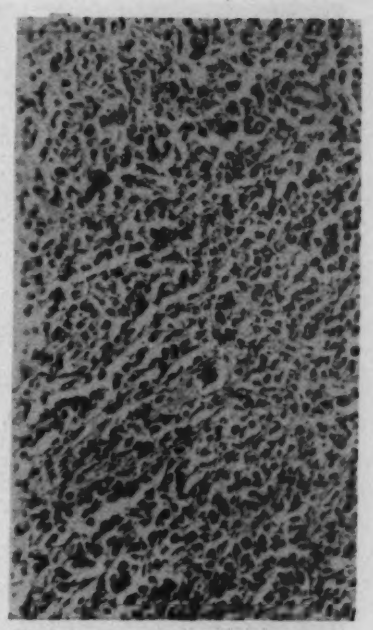

*Figure 4.—Case 2. Photomicrograph of reticulum cell sarcoma, showing cellular detail.*

*Case 3.*—A white woman, aged 17 years, was admitted to the U. S. Coast Guard Academy Hospital on 29 July 1949 with a history of obstruction of the left nostril since early childhood. In an automobile accident 11 years previously she was said to have sustained a fracture of her nose. At the same time the left upper central incisor was supposedly knocked out. In any event it was reported missing immediately after the accident.

Examination showed a bony, necrotic appearing tumor attached to the left side of the nasal septum at the level of the middle meatus. The tumor measured about 1 by 2 cm. and obstructed the left nostril. Dental examination showed the left upper central incisor missing, and also the upper left lateral incisor, which, however, had been extracted.

The tumor was easily removed with a snare as it was attached only by a soft tissue pedicle. It appeared grossly to consist of a hard, bony, cylindrical mass covered by mucous membrane, with areas of necrosis.

The pathologic report by Dr. James H. Peers was as follows:

"Microscopic findings: Sections show dense fibrous connective tissue patchily infiltrated by large numbers of lymphoid cells. The external surface is covered by stratified epithelium. In the center of the mass is a tract lined by pseudo-stratified ciliated columnar epithelium of respiratory type. No evidence of malignancy appears in the sections examined." (See fig. 5.)

*Figure 5.--Case 3. Photomicrograph of benign tumor removed from nasal septum.*

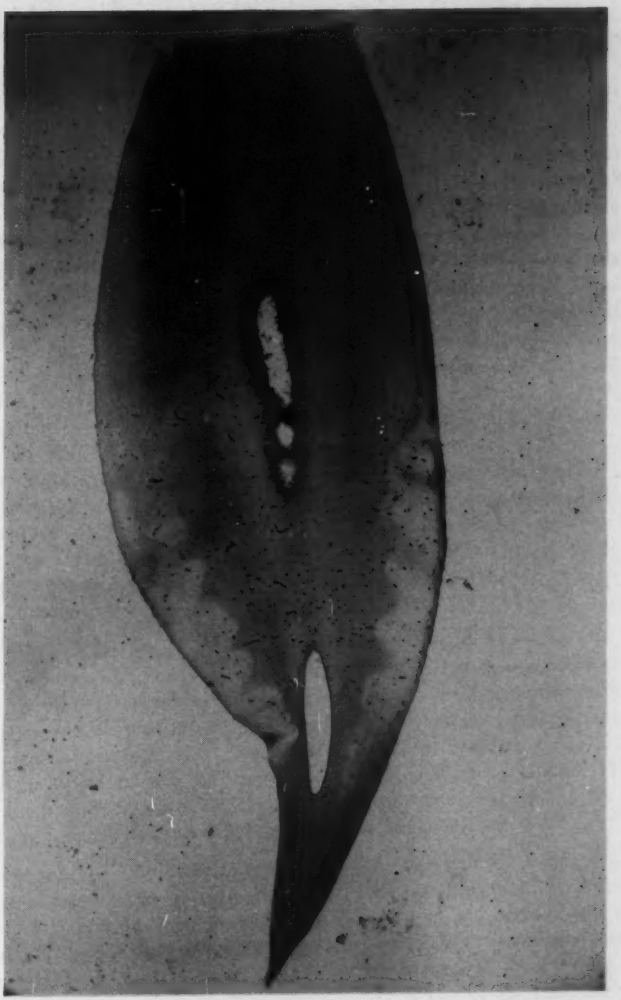

*Figure 6.—Case 3. Photograph of aberrant tooth structure contained in tumor of nasal septum.*

A supplemental report on the calcified part of the tumor was as follows:

"Examination of some of the calcified tissue removed from the nasal septum * * * unexpectedly shows it to have a structure resembling dentine. We are at a loss to understand the occurrence of such tissue in the nasal septum unless it represents an aberrant tooth bud, either congenitally misplaced or pushed out of its normal location at the time the patient's nose was fractured 11 years previously." (See fig. 6.)

After receipt of the supplemental report, and at the suggestion of Dr. Peers, a careful dental examination was made. The absence of the left upper central incisor, missing since the automobile accident, appears to support the theory of a tooth bud traumatically displaced into the nasal septum with gradual extrusion and pedicle formation.

# We Teach Each Other

## The Professional Educational Program in an Army Hospital

Harry L. Berman, *Lieutenant Colonel, MC, U.S.A.* (1)

A CONTINUING program of professional education for physicians is a desirable and important activity. This is as true for medical officers in the Army as it is for physicians in civil life. The policy of the Army Medical Service in this regard is clearly enunciated in par. 5, AR 350-1010, which states that "each Medical Department installation will participate in the professional education and training of Medical Service officers." In hospitals at posts, camps, and stations, and especially the smaller stations, as distinguished from general hospitals, the effective compliance with the provisions of this regulation is not easy. Among the difficulties which initially confront a group undertaking an educational program in a small or medium-sized station hospital are the lack of experienced clinical teachers, the possible inadequacy of clinical material, the shortage of training aids, and finding a time when a sufficient number of medical officers can assemble without interfering with other essential activities.

With these difficulties in mind and with a desire to have the best educational program possible with the means available, the commanding officer of this hospital appointed an informal educational committee to develop such a program. Because the supervision of this activity is a command function, the commanding officer of this hospital was constantly apprised of the committee's plans and recommendations; and because these had to be coordinated with other hospital activities, he was frequently consulted for advice and approval.

The purpose of this article is to describe the methods used to implement the prescribed policy regarding the professional training of medical officers in this 200-bed hospital with an active outpatient service. The educational committee in its initial meetings had to determine: (1) what the objectives of a professional educational program in this particular hospital should be; (2) what problems were to be anticipated in initiating this program and how they might be solved; and (3) how the program should be organized.

(1) U. S. Army Hospital, Fort Monmouth, N. J.

The objectives of the educational program were to: (1) enable medical officers to maintain their previously acquired medical knowledge; (2) facilitate their further education and training by providing guidance and direction; (3) stimulate them to increased individual reading and study, particularly in reference to their own patients; (4) provide them with a means of improving themselves in the fields of medical teaching and public speaking; and (5) provide favorable publicity for the Army Medical Corps, an item which was not anticipated originally but which became apparent, judging from the comments of the civilian physicians in the neighboring communities. The training of medical students, interns, and residents, which is an important feature in the program of a large teaching center, was not among these objectives, but could be on an affiliation basis sponsored by the nearest teaching hospital.

In initiating the program, the committee took cognizance of the statement in AR 350-1010 that "the maximum use will be made of facilities, equipment, instructors, and clinical material to develop and maintain a well-balanced program." Before this could be done, however, the vexing problem of assembling medical officers at a particular hour without interfering with important duties had to be solved. This required a conscientious effort on the part of all medical officers to organize their work in such a way as to permit their attendance at the various conferences. Where possible, certain hospital activities were changed from one time to another so as not to interfere with the training program. In general, conferences were scheduled for the same hour of the day. This assisted in instilling educational discipline in our medical personnel. Once this had been accomplished, attendance at the various conferences tended to become habitual; and as the program was developed, interest was stimulated and enthusiasm was engendered.

It also became apparent that any objections to the institution of this program because of a lack of facilities, equipment, instructors, or clinical material were not valid. The clinical material was entirely adequate and sufficiently varied for an interesting program. Equipment and training aids either were present to an entirely satisfactory degree or could easily be improvised. The members of the staff served both as students and as instructors. The entire program was built on the concept of: "We teach each other." The program consisted of (1) an x-ray conference (1 hour weekly), (2) a journal club (1 hour weekly), (3) a clinical conference (1 hour weekly), (4) a clinicopathologic conference (1 hour weekly), (5) grand rounds whenever a civilian consultant visited the hospital, and (6) a monthly hospital conference.

The x-ray conference is in charge of the chief of the radiologic service. Films of interesting cases are demonstrated and the findings correlated with those elicited on clinical examination and, when pertinent, with those made at surgical operation. This correlation is of tremendous importance not only to the clinician, whose decisions as to diagnosis, prognosis, and treatment may be vitally affected by it, but

also to the radiologist who gains valuable information as to the accuracies or inconsistencies of his diagnoses. Furthermore, the radiologist is able to obtain desirable information not readily available on the abbreviated forms used as requests for roentgen examinations. The radiologist is all too frequently called on to perform examinations without adequate clinical information. The information which he obtains at these conferences is often of help in the study of films of complex and puzzling cases. The radiologist is also able to assist the clinician in the proper selection of subsequent roentgenologic studies and in the avoidance of nonessential examinations.

In the journal club meeting one or two interesting articles from the current medical literature are reviewed. The articles selected are those having a general appeal. Their summaries are given in sufficient detail to permit the audience to have a proper understanding of their contents. It is believed that this method is preferable to that in which a number of articles on a variety of subjects are reviewed in a brief and cursory manner. More benefit is derived from a thorough review of one good article than from a brief survey of several. The reviewer must be prepared to answer questions on his subject. Journal club assignments are made according to roster.

The clinical conference is divided between the medical and surgical services, who present interesting cases from among those currently in the hospital. The number of cases presented varies, depending on the magnitude of the problem being considered in each instance. The responsible service emphasizes such aspects of the cases as they deem important. The patient is not presented unless certain specific signs can be shown. In preparing a case for presentation, the responsible group may call on medical officers from other services to assist them. For example, the laboratory officer may be called on to comment on the results of certain tests in connection with the case being presented.

The clinicopathologic conference is staged in the conventional manner (*2*). The laboratory officer is in charge of this conference. He selects a protocol from among those appearing in well-known medical journals. A copy of the protocol is given to the medical officer assigned to make the analysis of the case well in advance of the date of his respective conference. These assignments are also made according to roster. Other copies of the protocol are made available to all other medical officers several days prior to the meeting. The laboratory officer acts as both pathologist and moderator for the meeting. This requires him to make preparations in order to answer questions and to guide the discussion.

Grand rounds are held when a civilian consultant visits the hospital. Interesting and difficult problems are presented to the consultant for

(*2*) Glascock, H. W., Jr.: Use of clinical pathologic conference as teaching mechanism. Bull. U. S. Army M. Dept. 9: 392-398, May 1949.

his opinion and recommendations. An appropriate discussion accompanies each presentation.

The hospital conference is planned as a monthly meeting to be held at night so that the civilian physicians in the neighboring communities may attend. This meeting consists of a case presentation by one of the medical officers of this hospital and a talk on a subject of general interest by a prominent medical specialist, either civilian or military.

The use of the accepted methods of instruction is emphasized in the conduct of all conferences. Instructors are reminded to give careful attention to the preparation and manner of presentation of their subject matter. The adequate use of appropriate training aids, such as charts, drawings, roentgenograms, balopticon, and others is stressed. The educational program has been enthusiastically received by the members of the medical staff of this hospital because all concerned benefit from its operation. Problems are frequently clarified and new approaches to the solution of various problems are suggested. Clinical examinations and therapeutic procedures are performed with greater thoroughness and discrimination when there is a likelihood that one's work will be exhibited for the critical consideration of a group at a conference. The result is a higher standard of medical care because "we teach each other."

# About the Army Medical Service

## The Physician in the Present Emergency (1)

Paul I. Robinson, *Brigadier General, MC, U.S.A.* (2)

A NATIONAL emergency was declared by the President on 16 December 1950 as a result of the conflict in Korea. The commitment of our Armed Forces there resulted from a decision of our Government, as a member of the United Nations, to resist the aggression of the North Koreans in South Korea. Almost immediately our medical problem was evident.

The supply of medical officers in the Far East at the beginning of the Korean police action was inadequate as there were less than 200 Army physicians in the entire area which comprises Japan, Okinawa, Guam, the Philippines, and Korea. The whole Army was operating far below its needs in medical officers. Our only source of quickly available personnel was our residents, and within a matter of days 233 had been flown to the Far East. This number was supplemented rapidly by further depleting stations in the United States until, in November, there were 750 physicians available to the Army in the Far East. The brunt of the medical problems in Korea for several months was borne by Regular Army and Reserve officers then on duty. The excellence of the medical performance has been so often attested that it hardly need be repeated. It is now established that the death rate of patients who reach medical installations has been reduced to less than one-half that of World War II. The medical management has been accomplished by the best of the Regular Army Staff and Command officers who proved themselves in World War II and were thoroughly qualified by experience or Army training. The professional service has been accomplished by the products of our residency and internship programs. Although not many are board certified, many are board qualified. Typical of the remarks of eminent physicians on their performance is that of Dr. Howard D.

(1) Presented at meeting of the Association of Medical Officers of World War II, Toledo, Ohio, 18 January 1951.

(2) Chief, Personnel Division, Office of the Surgeon General, Department of the Army.

Fabing, of Cincinnati, in his report of his visit to the Far East, dated 30 December 1950:

"Some general impressions I gained during my visit may be worthy of record. First and foremost is the Army residency training program. I feel that it saved the bacon in the Korean War, and if it can never demonstrate another value, this alone has proved its worth. The rapid transfer of these young men to the Far East provided the bulk of the medical personnel in the first 6 months of the campaign. If there had been no group like this to draw on, the shortage would have been tragic. As a group they are keen, willing, and eager. They have done a worthwhile job, and many have accepted responsibility beyond their years."

It was obvious that the Korean conflict could not be supported by the few medical officers on duty with the Army. Appeals were made individually to about 3,000 medical Reserve officers in the grades of captain and lieutenant. Only 41 responded with requests for active duty. The medical profession and our Congress readily recognized the situation, and on 9 September 1950 an amendment to the Selective Service Act, providing for the registration and draft of physicians became law. The complexities and multiple agencies involved in the administration of this act brought many questions to the minds of all physicians.

The law itself divides physicians up to 50 years of age into 4 priorities for call to duty: (1) those ASTP or V-12 participants or deferees in World War II who served 90 days or less after training; (2) those in the same categories who served more than 90 days but less than 21 months; (3) those who did not serve in World War II; and (4) those not included in priorities 1 or 2 who did serve in World War II. The law also provided for the establishment of a National Advisory Committee to the Selective Service System. These considerations in the law provide the facts necessary for this discussion.

When this law was signed, the President communicated to the Secretary of Defense his belief that the priorities established in the Act appeared "to be logical and fair, both to the Government and to the individuals affected," and further: "If, as now seems certain, we shall not be able to meet our needs for doctors and dentists by volunteer service, it is my desire that the same priority of call be established for Reserve and non-Reserve personnel." At that time, the Army had only 38 medical Reserve officers who fell under the provisions of priority 1, and they had already been ordered to active duty. The Navy had 1,429 on its rolls. Because the Army had no priority 1 personnel in its Reserve in the light of the President's statements, and because the medical workload in the Army was increasing at the most rapid rate in history, the Navy called 570 of its priority 1 officers to duty and loaned them to the Army. It is planned that 100 of these officers be returned to the Navy each month.

Medical problems since World War II have been thoroughly studied by committees high in Government affairs. These studies resulted in the

establishment of the Medical Advisory Committee to the Secretary of Defense, and later also the position of Director of Medical Services in the Office of the Secretary of Defense; and more recently in the evolutionary development of the Armed Forces Medical Policy Council composed of a civilian physician as chairman, the three Surgeons General, and three civilian physicians or dentists. Also resulting from some of these studies was the establishment of the Health Resources Advisory Committee in the office of the Chairman of the National Security Resources Board. The chairman of the latter committee is Dr. Howard Rusk. The President also appointed the members of this committee to the National Advisory Committee to the Selective Service System. Therefore, the Rusk Committee, as it is now commonly called, wears two hats—that of the National Security Resources Board, and that of the Selective Service System. In each State an Advisory Committee to the State Selective Service Board has been appointed, and these committees also will, in effect, work on problems of medical resources as well as on Selective Service matters.

This describes the superstructure which has to do with a physician coming to duty with the Armed Forces. The agencies concerned are the Army, the Navy, the Air Force, the Office of the Secretary of Defense, the Selective Service System, the National Advisory Committee to the Selective Service System, the National Security Resources Board, and, at the State level, the Army Area Commanders, and the State and local Selective Service Boards and their Advisory Committees. To understand how it all works, it is necessary to drop back to mid-October when those in priorities 1 and 2 were registered by the Selective Service System. In addition to his registration form, each registrant completed a form outlining his training and experience and his desire as to acceptance of a commission in the Reserve. Following this registration, the Navy and Air Force were flooded with applications for commissions and active duty. Both, within a short time, granted commissions to all who could be used on active duty by their Departments up to July 1951. The Army also at this time had a number of "volunteers" from this group, but insufficient to meet its needs. In order to effect maximum use of knowledge of local conditions, the Army transferred all commissioning functions from Washington to the Army Area Commanders. The Navy and Air Force discontinued granting commissions to priority 1 registrants until the Army could catch up. We have not yet reached that goal. Those who had been classified in 1-A by local Selective Service Boards were ordered to take their preinduction physical examinations. About half of them indicated a desire to accept a commission and, if qualified, they are granted commissions by the appropriate Army commander. They then are ready for call to duty as needed. On orders to active duty, a physician may apply for delay and the Army commander is instructed to seek the advice of the State Advisory Committee in adjudicating his case.

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On 22 December 1950 a new element was introduced into the picture in the form of a directive from the Secretary of Defense prescribing that all requirements for physicians and dentists be submitted to the Secretary of Defense for review in the Office of the Medical Policy Council and the National Health Resources Advisory Committee for approval. The directive further requires that the names of all those who are proposed for call to duty after 1 April 1951 be submitted to the National Advisory Committee to the Selective Service System for check for availability by its local committees before orders to active duty can be issued. Furthermore, the names of all Reserve officers are to be submitted to the National Advisory Committee for determination of priorities of availability. Availability determination does not apply to those in Organized Reserve units or to volunteers. Since the Navy and Air Force are bringing only volunteers to duty, this part of the availability determination appears at present to apply only to the Army. The checks and balances are thus established.

Even these factors do not represent all the dispensations of the Federal Government to the individual physician. The ordinary maximum draft age (for other than the special draft of physicians and dentists) is 26, which in itself eliminates most of us because we ordinarily do not finish medical school before that age. We are at least allowed to finish our medical education, including an internship, before we are called by Selective Service. We are all eligible for commissions in the Armed Forces by virtue of our education. If we should be inducted we do not have to attend officers candidate schools to obtain commissions as do members of the other professions. We begin our service as first lieutenants where others begin at a lower rank. We are entitled to additional pay of $100 per month if we enter the service prior to call for induction. We are assured of pursuing our vocation in the service and our career systems assure that most of us will be continuously used in accordance with our special training and experience.

As of 16 January 1951, only 1,327 had accepted commissions. This number is sufficient to meet our requirements through March, and orders will be issued promptly. Our April quota is 300, and at this moment there are insufficient resources to meet the Army's needs for April and none for May or June. If more priority 1 - 1-A physicians do not accept commissions promptly, the Defense Department must place a requisition in the hands of the Selective Service System and inductions must begin. At its recent meeting in Washington, the National Advisory Committee recommended that all State committeemen urge priority 1 registrants to accept commissions without delay.

During the postwar years, the Army has conducted many studies and established many policies affecting its requirements for medical officers. As a result medical Reserve units now leave most of their physicians and nurses home when they are called to duty, and these join the unit when it is assigned an active mission. Tables of Organization and

Distribution have been revised and economies made in every instance possible. Administrative functions and duties have been shifted to officers in the Medical Service Corps. A recent calculation of requirements, when converted to ratios, amounted to 3.8 per 1,000 troops. Under this calculation the Army would have one physician for about 600 persons (including dependents) for which it has medical care responsibility. This compares favorably with any of our large cities where complete medical care is rendered. Because a division in combat requires more medical officers than one in training, we resist calculation of our requirements by means of a ratio and want our contemporaries to know that we can calculate them with much more intelligence than by the blind use of a ratio.

The physical standards which are in use for priority 1 special registrants are the same as those being used for induction of enlisted men. The rejection rate is running 20.2 percent at present; 46 percent of those rejected were deferees during World War II. The physical examination of every rejectee is being reviewed in the Office of The Surgeon General before final decision is made and questionable cases are being reexamined. The principal causes of rejection are tuberculosis, neuropsychiatric conditions, heart ailments, and peptic ulcers. Many with physical deviations from Profile C (or 3) (physical standard in use) have been accepted for duty. A proposal that a category of those who are available for all except combat duty has been made. We cannot justifiably accept those who would only create a medical workload for those who are well (and this is a real possibility in cases in which motivation is at a low ebb).

The Army is accomplishing its medical mission in a superior fashion and it is approaching its medical personnel problems in an intelligent and forthright manner. It is our wish to cooperate with the civilian medical profession and those agencies set up to distribute the added defense load equitably among the members of an already fully occupied and busy profession. In view of the present world situation every physician must so plan his career that he serves at least one tour of duty with the Armed Forces of his nation; every physician must take an active interest in his Armed Forces medical services and encourage them in their efforts to maintain a strong, well-trained, regular component; every physician must realize the gravity of the nation's present situation and lend his efforts to obtain the physicians required for the Armed Forces and, at the same time, cause as little disruption to civilian communities as possible. The physician must recognize the dispensations which are his, insofar as military service is concerned, and shoulder his full share of responsibility in his nation's efforts.

# A Proposed New Feature

## Listing of Articles Published in Other Journals by Personnel of the Medical Services of the Armed Forces

If a sufficient number of personnel of the Medical Services of the Army, Navy, and Air Force show an interest in furnishing information concerning articles which they have had published in other journals, this section will be made a permanent feature of the *Armed Forces Medical Journal.* Please give (1) the title of the article; (2) the names and ranks or rates of the authors; and (3) the name, volume and page numbers, and date of the issue of the journal in which the article was published.

—*The Editors.*

# BOOKS RECEIVED

**Progressive Resistance Exercise,** Technic and Medical Application, by *Thomas L. DeLorme,* B. S., M. D., Assistant in Physical Medicine, Massachusetts General Hospital; Consultant in Physical Medicine, Long Island Hospital, Boston; and *Arthur L. Watkins,* A. B., M. D., Assistant Clinical Professor of Medicine, Harvard Medical School; Chief of Physical Medicine, Massachusetts General Hospital. Foreword by *Joseph S. Barr,* M. D. 245 pages; illustrated. Appleton-Century-Crofts, Inc., New York, N. Y., publishers, 1951. Price $5.

**A Textbook of the Practice of Medicine,** by various authors. Edited by *Frederick W. Price,* F. R. S. Ed., M. D., C. M. Ed., F. R. C. P. Lond., Hon. M. D. Belf., Consulting Physician to the Royal Northern Hospital and to The National Hospital for Diseases of the Heart, London; formerly Physician and Honorary Pathologist to the Mount Vernon Hospital for Consumption and Diseases of the Chest, and Examiner in Medicine at The University of St. Andrews. 8th edition. 2,076 pages. Geoffrey Cumberlege, Oxford University Press, New York, N. Y., publishers, 1950. Price $9.

**Primer on Fractures,** Prepared by the Special Exhibit Committee on Fractures in Cooperation with the Committee on Scientific Exhibit of the American Medical Association. 6th edition. 109 pages; illustrated. Paul B. Hoeber, Inc., New York, N. Y., publishers, 1951. Price $2.

**The Practice of Sanitation,** by *Edward S. Hopkins,* Principal Associate Engineer, Bureau Water Supply, Baltimore, Maryland; Lieutenant Colonel, Medical Service Corps (Sanitary Engineering Section) United States Army Reserve; Instructor, McCoy College, Johns Hopkins University; formerly Special Lecturer, Western Maryland College; and *Francis B. Elder,* Engineering Associate, American Public Health Association, Colonel, Medical Service Corps (Sanitary Engineering Section) USAR. 423 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1951. Price $7.50.

**James Lind,** Founder of Nautical Medicine, by *Louis H. Roddis,* Captain, Medical Corps, U. S. Navy. 177 pages. Henry Schuman, Inc., New York, N. Y., publishers, 1950. Price $3.

**Clinical Parasitology,** by *Charles Franklin Craig,* M. D., M. A. (Hon.), Sc. D., (Hon.), F. A. C. S., F. A. C. P., D. S. M., Late Colonel, United States Army, formerly Director, Army Medical School, and Assistant Commandant, Army Medical Center, Washington, D. C.; Emeritus Professor of Tropical Medicine in the Tulane University of Louisiana, New Orleans, La., and *Ernest Carroll Faust,* M. A., Ph. D., The William Vincent Professor of Tropical Diseases and Hygiene and Head, Division of Parasitology, Department of Tropical Medicine and Public Health, The Tulane University of Louisiana, New Orleans, La.; Consultant to the Surgeon General, U. S. Army; Consultant, U. S. Public Health Service, with a

chapter on "Control of Medically Important Arthropods" by *Albert Miller,* B. S., M. S., Ph. D., Associate Professor of Parasitology (Medical Entomology) in the Department of Tropical Medicine and Public Health, The Tulane University of Louisiana, New Orleans, La. 5th edition. 1,032 pages; illustrated with 326 engravings and 6 colored plates. Lea & Febiger, Philadelphia, Pa., publishers, 1951. Price $12.

**Introduction to Surgery,** by *Virginia Kneeland Frantz,* M. D., Associate Professor of Surgery, College of Physicians and Surgeons, Columbia University; Associate Attending Surgical Pathologist, Presbyterian Hospital, New York, and *Harold Dortic Harvey,* M. D., Assistant Professor of Clinical Surgery, College of Physicians and Surgeons, Columbia University; Associate Attending Surgeon, Presbyterian Hospital, New York. 233 pages; illustrated. Oxford University Press, New York, N. Y., publishers, 1951. Price $2.75.

**Nitrous Oxide-Oxygen Anesthesia,** by *F. W. Clement,* M. D., Diplomate American Board of Anesthesiology; Fellow of the International College of Anesthetists; Fellow of the American College of Anesthetists; Member of the International Anesthetic Research Society; Member of the Ohio Society of Anesthetists; Chairman of the Section on Anesthesiology of the A. M. A., 1950; Past President of the Mid-Western Society of Anesthetists, 1932; Past President of the Associated Anesthetists of the U. S. and Canada, 1938; Formerly Director of Anesthesia at Flower Hospital; Mercy Hospital; The State Hospital for the Insane; Lucas County Hospital; and Toledo Dental Dispensary; Staff Anesthetist to Toledo and St. Vincent's Hospital; World War I—C. A. M. C. and R. A. M. C., 1914-1920; World War II—M. C., A. U. S., A. A. F., 1942-1945. 3d edition. 369 pages; 129 illustrations. Lea & Febiger, Philadelphia, Pa., publishers, 1951. Price $6.50.

**The Differentiation of Escherichia and Klebsiella Types,** by *F. Kauffmann,* M. D., Chief, International Salmonella Center, State Serum Institute, Copenhagen, Denmark. Publication Number 84, American Lecture Series. 57 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., Price $2.

**Paul Ehrlich,** by *Martha Marquardt,* with an introduction by *Sir Henry Dale.* 255 pages; illustrated. Henry Schuman, New York, N. Y., publisher, 1951. Price $3.50.

**Encyclopedia of the Eye,** Diagnosis and Treatment, by *Conrad Berens,* M. D., F. A. C. S., Executive Eye Surgeon, New York Eye and Ear Infirmary; Professor of Clinical Ophthalmology, Post-Graduate Medical School, New York University; President, Pan-American Association of Ophthalmology, Managing Director of the Ophthalmological Foundation, Inc.; President, Snyder Ophthalmic Foundation; and *Edward Siegel,* M. A., M. D., Attending Ophthalmologist, Champlain Valley Hospital, Plattsburg, N. Y.; Associate Attending Ophthalmologist, Physicians Hospital, Plattsburg. 272 pages; 76 illustrations, including 42 subjects in color. J. B. Lippincott Co., Philadelphia, Pa., publisher, 1950. Price $5.

**Physical Diagnosis,** by *Ralph H. Major,* M. D., Professor of Medicine, The University of Kansas. 4th edition. 446 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publisher, 1951. Price $6.50.

**Functional Anatomy of the Limbs and Back,** A Text for Students of Physical Therapy and Others Interested in the Locomotor Apparatus, by *W. Henry Hollinshead,* A. B., M. S., Ph. D., Head of the Section on Anatomy,

Mayo Clinic, Rochester; Professor of Anatomy, Mayo Foundation, University of Minnesota. 341 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publisher, 1951. Price $6.

**Current Therapy, 1951,** Latest Approved Methods of Treatment for the Practicing Physician, edited by *Howard F. Conn,* M. D. Consulting Editors: *M. Edward Davis, Vincent J. Derbes, Garfield G. Duncan, Hugh J. Jewett, William J. Kerr, Perrin H. Long, H. Houston Merritt, Paul A. O'Leary, Walter L. Palmer, Hobart A. Reimann, Cyrus C. Sturgis,* and *Robert H. Williams.* 699 pages. W. B. Saunders Co., Philadelphia, Pa., publisher, 1951. Price $10.

**A Classified Bibliography of Gerontology and Geriatrics,** Prepared for Stanford University under a grant from The Forest Park Foundation, Peoria, Ill., by *Nathan W. Shock,* Chief, Section on Gerontology, National Institutes of Health, and Baltimore City Hospitals. 599 pages. Stanford University Press, Stanford, Calif., publisher, 1951. Price $15.

**The Eye Manifestations of Internal Diseases** (Medical Ophthalmology), by *I. S. Tassman,* M. D., Associate Professor of Ophthalmology, Graduate School of Medicine, University of Pennsylvania, Philadelphia, Attending Surgeon, Wills Eye Hospital, Philadelphia, Pa. 3d edition. 672 pages, with 279 illustrations including 25 in color. The C. V. Mosby Co., St. Louis, Mo., publisher, 1951. Price $12.

**The Psychology of Flight,** by *Alex Varney.* 269 pages. D. Van Nostrand Co., Inc., New York, N. Y., publisher, 1950. Price $3.75.

**First Aid,** Surgical and Medical, by *Warren H. Cole,* M. D., F. A. C. S., Professor and Head of the Department of Surgery, University of Illinois College of Medicine; Surgeon-in-Chief, Illinois Research and Educational Hospitals, Chicago; and *Charles B. Puestow,* M. D., F. A. C. S., Clinical Professor of Surgery, University of Illinois College of Medicine and Graduate School; Chief, Surgical Service, Veterans Administration Hospital, Hines. Illustrated by *Carl Linden* and *Tom Jones.* 4th edition. 432 pages. Appleton-Century-Crofts, Inc., New York, N. Y., publisher, 1951. Price $4.

**Militant Angel,** by *Harriett Berger Koch,* R. N. 167 pages. The Macmillan Co., New York, N. Y., publisher, 1951. Price $3.

**Heart Disease,** Its Diagnosis and Treatment, by *Emanuel Goldberger,* B. S., M. D., Associate Attending Physician, Montefiore Hospital, New York; Cardiologist and Attending Physician, Lincoln Hospital, New York; Consulting Cardiologist, St. Joseph's Hospital, Yonkers; Diplomate of the American Board of Internal Medicine; Lecturer in Medicine, Columbia University. 651 pages, with 90 illustrations. Lea & Febiger, Philadelphia, Pa., publisher, 1951. Price $10.

**The Physiology and Pathology of Hemostasis,** by *Armand J. Quick,* Ph. D., M. D., Professor of Biochemistry, Marquette University School of Medicine. 188 pages, with 18 illustrations. Lea & Febiger, Philadelphia, Pa., publisher, 1951. Price $4.

**Exodontia,** by *M. Hillel Feldman,* D. D. S., F. I. C. A., Directory of Dentistry, Lincoln Hospital, Department of Hospitals, City of New York; Diplomate of the Board of Oral Surgery, State of New York; Fellow of the International College of Anesthetists; Founder of the American Society for the Advancement of General Anesthesia in Dentistry; Honorary Member, American Society of Anesthesiologists; with a chapter on Dental Malpractice Jurisprudence, by *Michael A. Hayes,* A. B., L. L. B., Mem-

ber of the New York Bar. 4th edition, thoroughly revised. 290 pages, with 322 illustrations. Lea & Febiger, Philadelphia, Pa., publishers, 1951. Price $6.50.

**An Introduction to Universal Serologic Reaction in Health and Disease,** by *Reuben L. Kahn,* D. Sc., University of Michigan Medical School and Hospital, Ann Arbor, Mich. 155 pages; illustrated. The Commonwealth Fund, New York, N. Y., publishers, 1951. Price $3.50.

**Trends in Gerontology,** by *Nathan W. Shock,* Chief, Section on Gerontology, National Heart Institute, National Institutes of Health, and The Baltimore City Hospitals. 153 pages; illustrated. Stanford University Press, Stanford Calif., publishers, 1951. Price $2.50.

**Psychosurgery in the Treatment of Mental Disorders and Intractable Pain,** by *Walter Freeman,* M. D., Ph. D., F. A. C. P., Professor of Neurology, George Washington University, Washington, D. C., and *James W. Watts,* M. D., F. A. C. S., F. I. C. S., Professor of Neurological Surgery, George Washington University, Washington, D. C. 2d edition. 598 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1950. Price $10.50.

**The 1950 Year Book of Urology** (October 1949 - October 1950), edited by *William Wallace Scott,* M. D., Ph. D., Director, James Buchanan Brady Urological Institute, Johns Hopkins Hospital; Urologist-in-Charge, Johns Hopkins Hospital; Professor of Urology, Johns Hopkins University School of Medicine. 416 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1950. Price $5.

**Toxicology of Uranium,** Survey and Collected Papers, edited by *Albert Tannenbaum,* M. D., Director, Department of Cancer Research, Medical Research Institute, Michael Reese Hospital, Chicago; formerly Senior Chemist and Toxicologist, Cook County Coroner's Laboratory, Chicago. 333 pages; illustrated. McGraw-Hill Book Co., Inc., New York, N. Y., publishers, 1951. Price $3.

# BOOK REVIEWS

**Biological Standardization,** by *J. H. Burn,* Professor of Pharmacology in the University of Oxford; *D. J. Finney,* Lecturer in the Design and Analysis of Scientific Experiment in the University of Oxford, and *L. G. Goodwin,* Member of the Staff of the Wellcome Laboratories of Tropical Medicine. 2d edition. 440 pages; illustrated. Oxford University Press, New York, N. Y., publishers, 1950. Price $6.75.

The pharmacologist engaged in research or standardization should not be without this excellent book. Although this book is not concerned with the action of drugs, it is vitally concerned with how to measure this action. The authors, with a basic scientific approach rarely seen in biologic texts, have devoted about 40 percent of the book to units of measurement, classification of methods, and statistical methods applicable to the particular problems of biologic standardization. The methods outlined by the authors, for the determination of mortality curves under the influence of various drugs, are as precise as any now available. These methods, although illustrated only by problems in pharmacology, could be used by workers in many other fields. The methods described are particularly valuable to the research worker whose problem calls for a careful evaluation of biologic variation between animals. This manual covers the biologic standardization of insulin, pituitary hormones, sex hormones, suprarenal hormones, thyroid and parathyroid substances, antipyretics and analgesics, digitalis, anthelminthics, antimalarial agents, and many others.—*Commander A. P. Webster, MSC, U. S. N.*

**Annual Reprint of the Reports of the Council on Pharmacy and Chemistry of the American Medical Association,** with the comments that have appeared in the Journal of the American Medical Association, 1949. 231 pages. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1950. Price $2.

This collection affords the reader competent information on pharmaceuticals which are new or are the subject of dispute. It includes sections on analgesics, chloresium, and organomercurial compounds and the omission of sulfathiazole from "New and Nonofficial Remedies." In addition, there is an article on statistics which should be helpful to many in the reading of scientific periodicals. This publication should be of interest with respect to current therapeutic trends for those who have no access to files of the Journal of the American Medical Association.—*Commander J. D. Wharton, MC, U. S. N.*

**Pneumoconiosis,** Beryllium, Bauxite Fumes, Compensation, edited by *Arthur J. Vorwald,* M. D., Director of The Trudeau Foundation and the Saranac Laboratory, with the collaboration of *Manfred Bowditch,* A. B., *Thomas M. Durkan,* M. E., and *Theodore C. Waters,* L. L. B. Leroy U. Gardner Memorial Volume. 659 pages; illustrated. Paul B. Hoeber, Inc., New York, N. Y., publisher, 1950. Price $7.50.

This memorial volume, dedicated to the late Leroy Upson Gardner, former director of the Saranac Laboratory and the Edward L. Trudeau Foundation, is the sixth in a series of Saranac Symposia devoted to the problems of pneumo-

coniosis and allied industrial hazards. The proceedings of this symposium were primarily devoted to beryllium. The history and industrial aspects are clearly evaluated in relation to the present industrial problem. The acute and chronic manifestations of beryllium poisoning are described and the pathology and physiology discussed at length. Experimental investigations by various technics are described and evaluated. Toxicity studies are reported in detail. Three papers are devoted to Shaver's disease which is restricted to workers inhaling the fumes from the electric furnaces used in the production of fused alumina. The clinical characteristics, the roentgenographic manifestations, and the pathology of this disease are exceptionally well described. This volume will be of value to industrial medical officers. An extensive bibliography covers the pertinent literature conceming beryllium which has been published up to January 1950.—*Capt. C. B. Galloway, MC, U. S. N.*

**A Textbook of Chemistry,** by *Stella Goostray,* R. N., B. S., M. Ed., formerly Director, School of Nursing, The Children's Hospital, Boston; formerly Educational Director and Instructor in Chemistry, School of Nursing, Philadelphia General Hospital; and *J. Rae Schwenck,* A. B., Ch. E., Chairmau, Chemistry Department, Sacramento Junior College; Lecturer in Organic Chemistry, Sacramento State College; formerly Instructor in, Nurses' Chemistry, Sacramento Junior College in co-operation with Sacramento County Hospital and Sister's Hospital. 6th edition. 401 pages; illustrated. The Macmillan Co., New York, N. Y., publishers, 1950. Price $3.75,

In the preface to this new book, the authors indicate that the aim of the text is "to present the fundamental principles of chemistry which would be of service to the student nurse, both in the practice of nursing and in understanding phenomena in other fields of applied science." They have presented chemical fundamentals in an interesting and lucid manner. The book employs the style made popular by Slosson in his classic "Creative Chemistry." In addition to knowledge of atoms, molecules, elements, oxidation and reduction, ionization, gas laws, radioactivity, et cetera, common to inorganic chemistry, the book successfully presents information in related fields. Modern theories are included in sections embracing colloidal, organic, and physiologic chemistry. Sections are included in which bodily functions, the significance of basal metabolism, and blood and urine analyses are amply discussed. Each chapter begins with an outline of what is to be considered and closes with a concise summary. To clinch assimilation of the context, stimulating review questions are presented. A practical appendix and good bibliography are included. The format is good and the print and paper should promote easy reading.

—*Lieut. L. J. Bodenlos, MSC, U. S. N.*

**A Laboratory Manual** to accompany **A Textbook of Chemistry,** by *Stella Goostray,* R. N., B. S., M. Ed., formerly Director, School of Nursing, The Children's Hospital, Boston; formerly Educational Director and Instructor in Chemistry, School of Nursing, Philadelphia General Hospital; and *J. Rae Schwenck,* A. B., Ch. E., Chairman, Chemistry Department, Sacramento Junior College; Lecturer in Organic Chemistry, Sacramento State College; formerly Instructor in Nurses' Chemistry, Sacramento Junior College in co-operation with Sacramento County Hospital and Sister's Hospital. 6th edition. 110 pages. The Macmillan Co., New York, N. Y., publishers, 1950. Price $2.

In this manual, 26 groups of experiments are presented which adequately cover the textbook matter. Lists of necessary reagents and appendixes are provided, all making for an instructive, easily comprehended practical review of theory.—*Lieut. L. J. Bodenlos, MSC, U. S. N.*

**Projective Psychology,** Clinical Approaches to the Total Personality, by thirteen leading exponents of projective techniques, under the editorial direction of *Lawrence Edwin Abt,* Ph. D., Research Associate in Psychology, College of Engineering, New York University, and *Leopold Bellak,* M. D., Lecturer in Psychology, School of Education, New York University. 494 pages; illustrated. Alfred A. Knopf, New York, N. Y., publisher, 1950. Price $6.

This book describes the theory and practice of projective psychology and was designed to provide easy reference material for the various projective technics used by the clinical psychologist. This objective has been attained. The book is divided into three parts. Part I presents the theoretical foundations of projective psychology. Part II contains separate papers devoted to various projective tests used in clinical psychology. Each paper has been prepared by a leading exponent of a certain technic indicating its special advantage. The result in a series of valuable contributions concerning such technics as the Rorschach test, the thematic apperception test, the mosaic test, figure drawing, the Szondi test, the Bender-visual-motor Gestalt test, the sentence completion test, and finger painting. Part III is devoted to an explanation of the application of projective technics to business, industry and action research. This book is recommended as a useful reference for clinical, educational, and industrial psychologists. It is particularly well suited for the psychiatrist who desires to become more familiar with the clinical psychologist's repertoire.
—*J. E. Rudasics*

**Physiology and Anatomy,** by *Esther M. Greisheimer,* B. S. in Education, M. A., Ph. D., M. D., Professor of Physiology, Temple University School of Medicine, Philadelphia; formerly Professor of Physiology, Woman's Medical College of Pennsylvania, Philadelphia; formerly Associate Professor of Physiology, the University of Minnesota, Minneapolis. 6th edition. 841 pages; 478 illustrations, including 52 in color. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1950. Price $4.

In this book the fundamentals of anatomy and physiology are presented. Clarity and simplicity are achieved by the logical manner in which the subject matter is presented and by the numerous excellent illustrations which include drawings, photographs, and roentgenograms. For the student's general information, each chapter contains a section in which the author relates the material to common pathologic conditions. This adjunct, included solely for general interest, serves, by comparison, to stimulate the student's interest in the normal anatomy and function of the human body. Recent advances and the newer technics in physiology are discussed and references to the original articles are cited. A brief section on aviation physiology introduces the student to problems peculiar to this rapidly expanding field. This is an excellent textbook for the nursing and physical education student, and a concise up-to-date reference book for the graduate nurse or instructor.—*N. V. Ricchiuti*

**Meat Hygiene,** by *A. R. Miller,* D. V. M., LL. B., Chief of the Federal Meat Inspection Service, U. S. Department of Agriculture, Washington, D. C. 420 pages; illustrated. Lea & Febiger, Philadelphia, Pa., publishers, 1951. Price $7.50.

This book is well written and covers the general subject of meat inspection, hygiene, and regulatory procedures related thereto concisely but thoroughly. The subject has been developed in such a way that the book is of value not only to personnel engaged directly in meat inspection and hygiene but to those indirectly concerned. This volume would be of value to Army veterinary officers when engaged in ante- and post-mortem inspections (particularly in theaters of operation overseas).—*Brig. Gen. J. A. McCallam, VC, U. S. A.*

**Psychosomatics and Suggestion Therapy in Dentistry**, by *Jacob Stolzenberg*, D. D. S. 152 pages; illustrated. Philosophical Library, New York, N. Y., publisher, 1950. Price $3.75.

This book can be recommended to the dental profession as a reminder of that part of patient-dentist relationship lost in the heavy workload of present-day practices, and as a means of conducting a positive approach to suggestive conditioning and control of the patient. Following background material on the psychosomatic concept as applied to dentistry the author discusses suggestive therapy in dentistry. Self analysis is a valuable by-product of this book.

—*Lt. Col. W. B. Simms, DC, U. S. A.*

**Pulmonary Ventilation and its Physiological Regulation**, by *John S. Gray*, M. D., Ph. D., Professor of Physiology, Northwestern University Medical School, Chicago, Ill. Publication No. 63, American Lecture Series. 82 pages; illustrated. Charles C Thomas, Publisher, Springfield, Ill., 1950. Price $2.

This short monograph on pulmonary ventilation is clearly and concisely written. The author describes the effects of changes in blood *p*H, $CO_2$ concentration, and anoxia on the respiratory system. He shows that pulmonary ventilation is a result of integrated regulation based on what is happening to the blood $CO_2$, $O_2$, and *p*H. He further shows that there are other factors controlling pulmonary ventilation which have not yet been determined and makes it clear that in studying this physiologic phenomenon it is necessary to distinguish between the 'steady state' in which there is a fixed association between actual concentration of the various chemoreceptors at the surfaces and the 'unsteady state' in which these concentrations are changing. He believes that many of the errors in interpreting results of past experiments were caused by a failure to distinguish the steady and unsteady state. The flight surgeon or other physician interested in aviation medicine will find this monograph valuable in interpreting the effects of altitude on pulmonary ventilation. For the general practitioner there are sufficient references to clinical conditions to make this book of interest.

—*Maj. J. N. Schaeffer, U. S. A. F. (MC)*

**Clinical Orthoptic Procedure**, A Reference Book on Clinical Methods of Orthoptics, by *William Smith*, O. D., Associate Instructor in Optometry and Instructor of Orthoptics and Visual Training, Massachusetts School of Optometry, Boston, Mass. 393 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1950. Price $8.

This book is published as a reference work on clinical methods of orthoptics. It aims to present the technics and results of orthoptic training for not only its classical use in anomalies of ocular position and amblyopia, but also in reading problems, accomodative abnormalities, myopia control, hysterical blindness, asthenopia, and astigmatism. The author has extensively perused the literature and is familiar with the products of almost every manufacturer of mechanical orthoptic instruments. To estimate the value of this book to members of the military service is difficult because the material is presented from the viewpoint of the nonmedical practitioner and depends on only those technics available to him. The results quoted by the author are phenomenal, as he claims that, in his hands, orthoptic treatment alone has cured defects for which ophthalmologists require cycloplegics, hormones, mydriatics, vasodilators, stimulants, sedatives, psychotherapy, vitamins, and surgery. There are, however, sufficient laxities in scientific exactitude to throw the thesis open to reasonable doubt.

Although the book includes many worthwhile quotations from other writings, various of the author's own statements are questionable, unproved, self-contradictory, or meaningless. Any medical officer who has re-examined recruits enlisted on the visual correctibility statements of a civilian optometrist, would tend to read with some disbelief the case records of examinees previously disqualified for ocular defects who qualified for enlistment, aviation duty, admission to the Armed Forces academies, and direct commissioning after only a few of the author's treatments. Procedures are fairly well described although there might be some objection to the dependency on commercial machines for effecting them.

The glossary of terms at the end of the text is presented at the high school student's level and the bibliography is weakened by the lack of a correlating key. Although the book is not without interest, to try to obtain workable orthoptic information from it is comparable to studying a proprietary drug's action from only the descriptive literature distributed by the manufacturer.

—*Commander E. J. Olenick, MC, U. S. N.*

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U. S. GOVERNMENT PRINTING OFFICE : O—1951